SPECIAL YEAR-END ISSUE
GREAT SMOKY MOUNTAINS NATIONAL PARK

RESOURCE MANAGEMENT AND SCIENCE

INSIDER

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SAFETY MESSAGE: For the fourth consecutive year, the lost-time injury rates for the entire park has increased. However, the total injury rate decreased for the first time in four years. The park had 56 total injuries last year for a rate of 20.14, or slightly more than 20 percent of our employees sustained an injury during the recording year. This was down from 2003 when we had 61 total injuries in all park divisions. The number of lost-time injuries was up slightly with a total of 23 injuries compared to 22 in 2003.

A brief summary of the most common types of accidents the park sustained reads:

- Slips/trips/falls: 13
- Pulled muscles/ligaments: 10
- Insect bites/stings: 6
- Struck by something: 6
- Bodily fluid exposure: 4
- Chemical exposure: 3
- Laceration: 3
- Struck against something: 3

Although our park-wide lost-time numbers continue to climb, the park continued to make progress in emphasizing park-wide safety. All divisions continued to improve in investigating accidents and identifying their causes. Each division provided safety training to their seasonal staff. Job hazard analysis continued to be completed. The Safety Officer was more active in working with branches within the respective divisions to identify and eliminate safety hazards that were not easily recognizable by the employee. Division Chiefs began to conduct audits of their work areas and processes. All three satellite safety committees were active and began to work on projects. The Cades Cove safety committee worked on finding a hat for those employees who are exposed to the sun regularly to protect them from skin cancer, and continued working on an emergency evacuation plan for the Cove. North District developed a Wellness Program and is in the progress of coordinating a health fair with community health care professionals that will be held in the headquarters area. South District formed new membership and selected a chairperson and recorder, agreed upon it's charter and is also working on a health fair to be held in the Oconaluftee area. For specific accomplishments within the Resource Management and Science Division, see the Division Chief's report below

SAFETY RECORD: The Park has gone 86 days without a lost time accident. The lost-time frequency rate is 0 injuries per 100 employees. Resource Management and Science Division has gone 86 days without a lost-time accident.

DIVISION CHIEF – Larry Hartmann, Division Chief (865-436-1245)

SAFETY EMPHASIS: This year the park, and our Division, placed a strong emphasis on safety. We developed a new training course called "First on the Scene," designed to tell our employees what to do if they were the first park employee to arrive at the scene of an accident. Last year, four of our employees faced that stressful and demanding circumstance, and many more have been "first on the

scene" at some point in their careers. We also had all RM&S Division employees take a park-specific driving test which focused on safe driving practices in situations commonly faced in the park, and the results of that determined which of our employees took an internet-based refresher course in safe driving. We use Farm Utility Vehicles (FUV) for some of our work, and these can be tricky to drive, especially when fully loaded and traveling on uneven or steep terrain. So, even though we have had no FUV accidents, we provided FUV operators with a specialized course in safe operation of those vehicles. Next year, we plan to hold similar training for operators of All Terrain Vehicles (ATVs). We also held "Lessons Learned" sessions for most of the accidents we had in our Division, and released information on park accidents to all Division employees. We completed safety inspections of some of our field sites, and fixed most of the safety problems we found (and are working on fixing the remaining, more expensive problems). We maintained an emergency contact list of all employees, just in case we had to contact a next of kin in the event of a serious injury – thank goodness we never had to use it. Overall, although our accident rate is not what we would like to see, we avoided any serious accidents, and are taking many actions to reduce the accident rate in our Division. The total number of injury accidents in FY04 within our Division was 18 and we had six lost-time accidents. We also had two motor vehicle accidents.

COPING WITH TIGHT BUDGETS: Budgets are tight everywhere as priorities shift during these difficult times. Most of our budget goes toward personnel salary. In FY 2004, we coped with tight budgets by not filling positions that became vacant, either by employees retiring or leaving to take other jobs. We lost one hog hunter, one fisheries biologist, and our Branch Chief of Natural Resources. Previously, we lost other positions throughout our division that also remain unfilled. This year, we were unable to fund any seasonal employees with base funds. We are finding ways to cope with the loss of positions. The biggest change was a restructuring of our Division, necessitated by our inability to fill in behind our GS-13 Branch Chief for Natural Resources, Carroll Schell. The four sections that he supervised – Vegetation Management, Wildlife Management, Fisheries Management, and Air Quality Monitoring – now report directly to the Division Chief. We also split up the other management functions that Carroll performed so the most important work is still being done, at the cost of additional workload on our already busy staff. We are relying more on volunteers from the Student Conservation Association for our seasonal workforce. And some lower priority work is just not being done.

PROTECTING PARK RESOURCES THROUGH COMPLIANCE: All "Federal Actions" undertaken by the park are reviewed for compliance with the National Environmental Policy Act (NEPA) and National Historic Preservation Act (NHPA). Dr. Hartmann serves as the Park's Compliance Officer, and determines what level of compliance is needed, what subject matter experts need to review the project plans, and manages the review by the Compliance Management Board, which is comprised of one voting member from each Division. This Division puts in a considerable percentage of our time in providing information for major and minor compliance projects, either reviewing projects ourselves, or providing information and reviewing reports provided by contractors working on major EIS and EA projects. In Fiscal Year 2004, while we were nearing completion of the EIS for the Ravensford Land Exchange with the Eastern Band of the Cherokee Indians, the exchange was completed through a Federal legislative action. There is still a small group of our employees involved with oversight of the construction of the three-school complex soon to be build on the land exchange site. Our Division staff has devoted a considerable amount of time this year to the three other major EIS projects ongoing in the park – the Cades Cove Opportunity Plan, the Elkmont Historic District planning, and especially the proposed North Shore Road. In addition to these large projects, we have conducted environmental and cultural reviews of 32 smaller compliance projects this year, ranging from putting up signs in areas of known historical resources to replacements of bridges and roads washed out by storms.

APGI LAND EXCHANGE COMPLETED: For the past five years, an interagency group has been quietly working on a complex agreement that was signed into law this week. This bill authorizes a land exchange between Great Smoky Mountains National Park and ALCOA Power Generating Inc (APGI). APGI is charged with operating four hydropower dams and reservoirs in East Tennessee and Western North Carolina. Making a long story short, these dams needed to be relicensed, but during the relicensing process, it was found that one of the reservoirs flooded land inside the park. The

Federal Energy Regulatory Commission (FERC) does not have the legal authority to issue licenses for hydropower projects that flood lands within the authorized boundary of a national park. Agreements were developed which would allow the dams to be relicensed, through continued inundation of some land that would be transferred to APGI. In return, APGI has agreed to a series of land donations and other actions which offer very significant conservation and recreational advantages to the National Park Service (NPS), to the USDA Forest Service (USFS), and to recreational and conservation stakeholders. These actions are a product of five years of highly collaborative discussions between AGPI, FERC; the NPS, the US Fish and Wildlife Service and the Bureau of Indian Affairs; the USFS; the Eastern Band of Cherokee Indians; the State of Tennessee; and five non-government organizations: National Parks Conservation Association, The Nature Conservancy, National Forest Foundation, American Rivers, and Tennessee Clean Water Network.

The Smokies will transfer approximately 100 acres of submerged national park land to AGPI. In exchange, AGPI would donate in fee approximately 200 acres of dry land bordering the Smokies to Great Smoky Mountains National Park. An additional 400 acres of AGPI-owned land would become part of a permanent conservation easement. The park will have two years to purchase fee interest in this additional 400 acres. In addition to the 600 acres of land, which may be owned in fee by the park, AGPI has agreed to donate a permanent conservation easement on 5,000 to 6,000 acres of land that will create a “conservation corridor” linking the 521,000-acre Great Smoky Mountains National Park and the 640,000-acre Cherokee National Forest.

AGPI has further agreed to establish a conservation/mitigation fund of $100,000 per year. This funding would be available to the NPS, USFS, or TNC and others to fund such things as reduction of invasive non-native species and wildlife habitat improvement. There is also a $25,000 per year fund to be used for projects in North Carolina.

The legislation signed this week by the president will be a terrific asset to the park for years to come. Recent retiree Carroll Schell was the division contact for this complex, and his efforts on this project will be felt for decades.

INVENTORY AND MONITORING – Keith Langdon (865-436-1705)

Inventory and Monitoring Branch Office

Principally, the I&M Branch works on natural resource inventories, long-term monitoring, review and management of the research collecting system, and provides on-going involvement into Environmental Impact Statements for several large projects. It also has data management and Geographic Information System responsibilities for the branch, division and other park offices.

In general, the severe budget constraints in FY 2004 meant that one permanent position was abolished, and another could not be filled. In addition, for the first time, no seasonal positions were filled (except for high school students at Purchase Knob via a grant from the Burroughs-Wellcome Foundation). Seasonal positions are the backbone of our small crews, without them many backcountry operations were not possible due to safety and logistical efficiency.

One function that has increased in branch time commitment many fold in the last several years is our involvement in environmental reviews, and formal Environmental Impact Statements, as a part of the compliance operations mentioned above. Often we assist in selecting the natural resources to be studied, write criteria for scopes of work via contract, gather past studies and data, help select potential contractors, perform field reconnaissance, evaluate data, attend and answer questions at controversial public meetings (often 20-25 meetings per project), and involvement in post-EIS implementation plans.

In FY ’04, significant time was spent by multiple I&M staff on the following projects:

- Ravensford Land Exchange EIS and subsequent Memorandum of Agreement

- North Shore Road EIS
- Elkmont Historic District EIS
- Cades Cove Opportunities Plan
- Alcoa/Park Land Exchange EA

In addition, routine, usually more minor projects get reviewed in the I&M Office. Park Botanist Janet Rock and other professional staff make site visits to search for rare/threatened/endangered species and other unique natural resource elements of management concern.

SCIENTIFIC RESEARCH & COLLECTING PERMITS: Permits to do research and to collect resources may be approved for members of organizations/institutions that are conducting research or educational activities. Applicants for research must submit a proposal describing the work, and those who are proposing inappropriately manipulative or overly destructive methods, or actions that could easily be conducted elsewhere are referred elsewhere. The number of permits continues to rise, with another record-breaking year of activity. Efforts undertaken by outside universities, museums, and agencies are often our only way to obtain scientific data that we cannot otherwise afford. Permits for cultural/archeological resources are handled elsewhere.

In FY 2004, a team consisting of I&M Coordinator Keith Langdon, Entomologist Dr. Becky Nichols, Museum Curator Dr. Adriean Mayor and Office Assistant Sue Powell was set up to review all incoming applications. The team meets about every two weeks more or less depending on the need. Several permits were placed on indefinite hold/denied pending answers to queries made by team members to applicants.

The following list is a breakdown of the 200 permits that were active on September 30, 2004. It does not include some permits that may have been issued in the previous calendar year (2003) portion of FY 2004 (the permit system operates on a calendar year). About half the permits are associated with the All Taxa Biodiversity Inventory. Often there are 2-4 scientists per permit, and few permits have many scientists listed on them, e.g. for bio-blitzes. The assignment of subject fields is difficult since a number of projects examine more than one field. If you have specific questions contact Keith Langdon.

Subject Field of Permit	Number of permits as of September 30, 2004
Terrestrial Invertebrates (includes parasite work and some bio-control work)…	55
Forest Ecology……....	24
Botany (usually single species focus or taxonomic group)……	22
Fungi/Eumycetozoans……	14
Amphibians……	11
Aquatic Invertebrates……..	10
Mammals……	9
Air Quality/Air Pollution Effects…….....	8
Educational (non-research, temporary collecting)…….....	8
Geology……	5
Fire Related……	5
Birds……	5
Soils/Soil Nutrient Cycling……	4
Hydrology/Water Quality…….....	4
Other - permits for those supporting numerous other fields……	4
Environmental Assessment/EIS (blanket permits for contracted work)……	3
Reptiles……	2
Visitor Survey……	2

Vegetation Monitoring/Forest Ecology

Long Term Vegetation Monitoring-budget cuts in 2004 led to the elimination of seasonal positions in the Vegetation Monitoring Program. Because we were unable to hire summer field crews, no new

long-term vegetation monitoring plots were sampled during the 2004 field season. This reduction in staff has delayed the establishment of the first scientifically stratified plot array for vegetation in the park. The sampling strategy was developed in cooperation with Dr. Peter White at University of North Carolina-Chapel Hill who led a team to develop a computerized landscape classification system for sampling.

FINAL DRAFT OF THE NEW VEGETATION MAP RECEIVED: After over six years of cooperative effort between the Smokies and the University of Georgia's Center for Remote Sensing and Mapping Science, the park received the final version of the new wall-to-wall vegetation maps of the park. These maps are actually expressed as five different themes for the entire half million acres of the park: 1) forest overstory, 2) understory (esp. rhododendron/mountain laurel), 3) photo mosaic, 4) percent leaf cover, and 5) wild land fire fuel class. We have also received the final report that provides documentation of the methods and results of the project. We are funded to conduct an independent accuracy assessment of the maps in the coming months, the final step in making the maps fully useable. At this point, we believe that they are reasonably accurate portrayals, but we are eager to check the data before they are widely released.

SOILS MAPPING PROJECT CONTINUES: The park's soils mapping project proceeded steadily, with over 4/5 of the park's acreage now mapped by USDA-Natural Resource Conservation Service. Twenty new soil types have been discovered and are being technically described. By the end of December 2004, the park will receive the first digital product from this project. A single USGS 1:24,000 Quadrangle from within the park will be available for review and comment. NRCS has initiated two cooperative studies with the University of Tennessee to more closely study some interesting aspects of this project. The first of these will examine the acid generating potential of soils identified in the mapping effort. The second will examine the mineral building blocks of soil through the use of x-ray defraction. This project is coordinated for the park by Dr. Mike Jenkins.

SEVERAL ONGOING PROJECTS CONTINUED: Dr. Jenkins serves on the committee of the following three PhD students, who are actively engaged in research assessing status, impacts and/or possible management alternatives to serious ecological threats to Smokies forests.

a. Fire and Dogwood Reproduction: Mike Jenkins provided guidance to Eric Holzmueller, a Ph.D. student from University of Florida, during his third and final field season. Dogwoods have been decimated in the Appalachians by an exotic anthracnose fungus from the Orient. These studies have shown that where one fire occurred in the 1970's, there were about three times as many dogwood stems surviving, and the effect was even more pronounced if the site had burned again in the 1980's. Sites that have burned 2-3 times were sampled and two new field experiments were initiated. The first of these examined the contribution of three soil cations (potassium, magnesium, and calcium) to dogwood survival following anthracnose infection. Over 300 containerized dogwood seedlings were randomly treated with 12 different fertilizer treatments. Seedling survival and condition were tracked through the 2004 growing season. A second experiment examined the contribution of dogwood trees to the mineralization of calcium in forest soils. This study looked at the rate of litter decomposition and calcium release in stands containing different densities of living dogwood trees.

b. Fire and *Paulownia* Reproduction and Survival: Dane Kuppinger, a University of North Carolina-Chapel Hill Ph.D. student, completed his third and final year of field work for this project. Initial results indicate that canopy cover and soil exposure are significant predictors of forest stand invasion by this Asian tree species. Experiments to examine the response of *Paulownia* seeds to heat and litter depth were initiated in 2004 and will be conducted again in 2005. This project was funded by the Joint Fire Science Program through a grant written by Mike Jenkins and Dr. Peter White of the University of North Carolina.

c. Impacts of Beech Bark Disease on High Elevation Beech-Dominated Forests: David Vandermast, a Ph.D. student from the University of North Carolina-Chapel Hill, has continued to analyze data collected in this project. Comparing plots established decades before, beech stems have increased in the western part of the park at high elevations, but there is heavy mortality (up to 100 percent of stems) in the eastern half of the park. This is because of the

establishment of beech bark disease from Europe. Very interesting are the declines detected in high elevation mixed species forests: oaks, beech, birch and buckeye are all declining. Maples are increasing, and some indications point to soil acidification. The Smokies are known to receive high amounts of acid deposition, and at soil pH of less than 4.5 nutrients such as calcium, potassium and magnesium are leached and root-toxic aluminum is mobilized. Of the 40 plots in this study, all but three had soil pH below 4.5.

NEW PROJECTS INITIATED IN 2004:

a. Vegetation Changes in Woodlots of Cades Cove: A collaborative study was initiated in 2004 with Michigan Technological University (MTU) to examine changes in Cades Cove vegetation that have resulted from succession and chronic deer herbivory. The first part of this project examined spring flora inside and outside of exclosures within Cades Cove. Data suggest that recovery of spring flora inside the fenced plots has largely been restricted to those plant species that can persist under intense deer herbivory. Many plant species such as Catesby's trillium that were common at a reference site with fewer deer, were found in very small numbers in the Cades Cove plots and area. A manuscript for publication was submitted to *Biological Conservation* by Dr. Chris Webster (assistant professor at MTU), Mike Jenkins, and Janet Rock. This manuscript was accepted pending revision and has been revised and resubmitted.

b. A second part of the study examined changes in woody overstory and understory vegetation over the past two decades. Nineteen existing vegetation plots were resampled throughout the Cove. Woody understory species have declined by several measures including diversity, richness and density. A paper describing these results, co-authored by Chris Webster, Mike Jenkins, and Janet Rock, was accepted for publication in *The Journal of the Torrey Botanical Society*. The final part of this project will look at changes in the summer flora on the same 19 plots and within three sets of deer exclosures and control plots in Cades Cove. Jennifer Griggs, a graduate student at MTU, completed field work on this part of the project during the summer of 2004.

c. Distribution and Successional Trends of Hemlock Dominated Forests: A project was initiated with Clemson University to begin analyzing plot data collected in hemlock stands within the park. Mark Webb, a former biological science technician in the Smokies and current Clemson M.S. student, is examining successional changes in hemlock forests over the past two decades and physiographic characteristics related to hemlock dominance. His project is being overseen by Dr. Victor Shelburne of Clemson and Mike Jenkins will serve on his graduate committee.

ASSISTANCE AND OUTREACH: Dr. Jenkins continued to work with the Obed Wild and Scenic River on an assessment of the impacts of a major oil spill and subsequent fire on forest vegetation. He revisited the site to assess overstory and understory mortality and examine impacts on herbaceous vegetation. Numerous tree cores and disks were taken from dead trees. Annual ring widths measured from these samples will be used to estimate the rate of biomass accumulation at the site prior to the fire.

<u>Aquatic Microinvertebrates</u>

MACROINVERTEBRATE SAMPLING: Dr. Becky Nichols was not able to sample the permanent long-term aquatic macroinvertebrate sampling sites this year, due to a lack of funding to hire a seasonal position. (Sampling in remote mountain streams is not safe or efficient with one person.) This program is designed to provide trend information regarding the health of streams in the Smokies. The lack of data collection was unfortunate, as it breaks the continuity of monitoring and therefore reduces the confidence of trends detected. Time was spent this year further analyzing previous years' data and refining protocols.

COMPLIANCE: Nichols was involved in many compliance issues throughout the year. Some of these projects included the proposed North Shore Road EIS, the Smokemont sewer line installation EA, the

Elkmont historic district EIS, and the Ravensford EIS. Early in the year, Becky was part of a team of biologists from the Inventory and Monitoring Branch conducting a "walk-through" survey of the proposed North Shore Road corridor – a 25-mile trek that included detection of aquatic resource communities and spot sampling.

OUTREACH: Becky gave eight ATBI presentations to various groups, including a poster presentation at an invertebrate conservation symposium, held in New York City at the American Museum of Natural History. This symposium was sponsored in part by the National Park Service (thanks to the Friends and DLIA for funding travel). These presentations were given to educate and inform groups about what kind of data is being collected and how it is being used. She also participated in meetings with groups from other natural areas, such as the Tennessee State Park system, who are now planning to conduct an ATBI. Other aspects of the ATBI that Nichols works on include TWIG (Taxonomic Working Group) organization, compilation of species lists for new to science species and new records to the park, and science editing for the ATBI Quarterly (see section below on the ATBI for latest compilation of species).

ONGOING PROJECTS: Funding was obtained in 2004 through the Great Smoky Mountains Association to conduct a status survey of the endangered spruce-fir moss spider, *Microhexura montivaga*. The last limited survey was conducted in 1991. This tiny, tarantula-type spider was listed as federally endangered in 1995 and critical habitat was designated in 2001. Its microhabitat is restricted to only certain areas of rock outcrops and boulders in Fraser fir and/or fir dominated spruce-fir forests. Because this type of habitat has changed dramatically over time, another survey was necessary to determine the location and relative abundance of populations in the park. Field work is being conducted by Dr. Fred Coyle, professor emeritus at Western Carolina University, and is coordinated by Dr. Nichols.

ATBI RESEARCH PROPOSAL: During the year, Dr. Nichols led in writing a draft proposal for submission to the National Science Foundation in January for conducting ATBI research in the park. Scientists involved included: Dr. Ernest Bernard, University of Tennessee, Dr. Richard Baird, Mississippi State University, Dr. Sean O'Connell, Western Carolina University, and Dr. Paul Bartels, Warren Wilson College. This research proposal is a multi-domain approach to the discovery and identification of soil and litter-dwelling organisms from selected groups, which include archaea, bacteria, ascomycetous micro fungi, nematodes, tardigrades, and arthropods (Collembola, Protura, Pauropoda, Symphyla, Diplura, Pseudoscorpiones). All groups proposed are related to the detritus-based food web and typically are underrepresented in biodiversity estimates.

Botany

NPSPECIES DATA MANAGEMENT SYSTEM: Janet Rock worked with Mark Wotawa (Natural Resources Information Division in Fort Collins, Colorado) to create a definitive plant species list for the Smokies. The list of 1,637 vascular plants can now be accessed through NPSpecies, a database developed by the NPS service-wide Inventory and Monitoring Program to document the occurrence of significant natural resources in every park unit. It will be made available to the general public on-line in the next few months. Other lists completed for the database are park amphibians and odonates (dragonflies and damselflies).

Natural History Collection

CATALOGING SPECIMENS: Dr. Adriean Mayor finished his first year as the park's museum curator. On a daily basis Adriean deals with the natural history specimens and the collections room located in the basement of the Sugarlands Visitor Center. In dealing with the collections backlog, more than 3,000 records have been entered into ANCS+ this year; and more than 10,000 records have been modified. These modified records will make data searches easier to perform, and will insure that all relevant records are accessed.

DRIP DRIP DRIP: A serious moisture problem was detected in the rear of the collections room in the summer. Condensation was entering the room and starting to affect the cases that contain specimens

and artifacts. The regular inspection caught it in time, but the problem proved difficult to deal with since the solution involved modification of the HVAC for the entire visitor center. Other monitoring has picked up insects on glue boards - all at points of entry into the room - but the collections room is not believed to be infested.

THE ANTS CAME BACK: Adriean successfully negotiated with the Los Angeles County Museum of Natural History for the return of a set of vouchers of ants from the A. C. Cole collection that had been collected in the Smokies in the 1930's thru 1950's. Examples representing 64 ant species found in the park were returned, and have already been used by researchers from The University of Tennessee and Clemson University. Ants play a significant and important role in forest litter decomposition, and are the subject of several on-going research projects in the park. A side note: E.O. Wilson, the famous Harvard University ecologist, two-time Pulitzer Prize winning author and premier world authority on biodiversity, was briefly a graduate student of Dr. Cole's at the University of Tennessee.

THRIPS TRIP: Dr. Mayor shipped a major loan consisting of thousands of specimens of thrips to Dr. Arturo Goldarazena a researcher in Spain for identification. Dr. Goldarazena is a world authority on thrips. Thrips are tiny insects often found in large numbers in flowers. Most feed on plants, and some are serious disease vectors, while others are predators of small insects and other arthropods. In this region, thrips are also a primary vector for rose rosette disease, a virus which infects the exotic, invasive multiflora roses (but apparently not native species), and causing them to die-back.

Two loans, both of leaf beetles were returned to the park this summer, and the catalog records have been updated. Leaf beetles are a significant component of the park fauna, most feeding on the leaves of flowering plants.

COOPERATION WITH VISITING RESEARCHERS: Numerous scientists visited the museum this year, from research institutions around the country, including the University of Tennessee, Clemson University, Texas A & M University, Brigham Young University, Philadelphia Academy of Natural Sciences, Central Missouri State University, and the Florida State Collection of Arthropods, just to name a few. Areas of research interest ranged from slime molds to insects.

Appalachian Highlands Science Learning Center at Purchase Knob

COOPERATIVE RESEARCH: Sixty-five scientists and their students, representing roughly 25 fields of study and 33 Research Permits, made use of the Purchase Knob facility. Of the roughly 1,160 researcher nights available at the Purchase (October, 2003; May 1 through August 22, 2004), individuals or groups conducting research used 24 percent. Numbers were slightly up from 2003 (compared to 21 percent occupancy) despite scheduling uncertainties with the on-going reconstruction of the Purchase Knob facilities, which prevented researchers from planning their trips to the site far in advance. There were 441 researcher workdays in FY 20004, down 20 percent from last year. Twenty of these researchers participated in educational programs, training interns and volunteers during their stay. Learning Center staff assisted with the work of an additional seven research permits where the scientists did not visit the Purchase Knob facility. Research topics include the effects of drought on plant response to ozone, physiological effects of competition between native and non-native plants, ecological controls on ant diversity, speciation and hybrid-zone dynamics of salamanders, surveys of northern flying squirrels and parasites of birds, bird migration, and ATBI studies of slime molds, soils, grasshoppers, katydids, algae, plant hoppers, gall-making flies, moths, and soil microbes, as well as vegetation mapping of the Blue Ridge Parkway.

BURROUGHS WELLCOME FUND: The Science Learning Center was in the second year of a three-year $165,100 grant from the Burroughs Wellcome Fund's Student Science Enrichment Program, made possible by the Friends of Great Smoky Mountains National Park. Jonathan Mays, whose position is paid for by this grant, continued to assist with the research activities throughout the North Carolina side of the park and to teach the curriculum-based middle school Parks as Classrooms programs at Purchase Knob, where students learn about science by helping to collect real data in the field. The grant also paid for the hiring of a college intern and 12 high school interns from six North Carolina high schools. The interns from Graham, Jackson, and Haywood Counties and the Qualla

Boundary, worked from June 1 through July 27, getting hands-on experience with field research while assisting visiting researchers and working on a variety of projects throughout the North Carolina side of the Smokies, with Jonathan's assistance. Projects included inventories of plant hoppers, algae, moths, spiders, and beetles, studies of individually marked salamanders and snakes, ozone effects on native plants, and a study of the effects of the Sharps Ridge Fire on invertebrate communities (in its second year). Through their work, interns have led to the addition of two new park record spiders, and one new park record beetle. Taxonomists are still identifying material collected.

REAL-TIME AIR QUALITY WEB-CAM, AND MONITORING THE SOUNDS OF THE SMOKIES: The real-time air quality web-cam at Purchase Knob, made possible by a grant last year from the Friends of Great Smoky Mountains National Park, has been averaging over 26,000 hits each week in FY 2005, with a weekly high of over 48,000 hits. Now the public can check the current weather and ozone levels for the eastern edge of the Park and can see the visibility almost completely across the park and on to Mount Mitchell. The park is working with the Air Resources Division on a new project to monitor the ambient sound-scape of the Smokies. Sound is one of the resources most valued by National Park visitors, yet little has been done thus far to document the nature of this resource or how it may be changing. Soon visitors to the web-cam site will be able to listen to the most recent 20-second recording (made every five minutes) of the sound of Purchase Knob, as well as archived recordings of coyotes, birds, airplanes, and quite probably researchers. The address is http://www2.nature.nps.gov/air/webcams/parks/grsmpkcam/grsmpkcam.htm .

RECONSTRUCTION UPDATE: Work began this fall on reconstructing the main building to better accommodate the needs of the Research Learning Center. Asbestos and lead paint have been removed from parts of the house that will be remodeled, peeling exterior paint and rotting decorative eves have been removed or replaced, and a new roof will soon be installed. During FY 2005, the master bedroom will be converted into a conference room. Changes will also be made to the bathrooms, bedrooms, and kitchen to better reflect their current use as state of the art research station lodging. We look forward to this work being completed no later than spring 2006, in time for a full research season.

In the meantime, a grant from Unilever Corporation, made possible by the National Park Foundation, has provided the materials to construct five temporary tent platforms so that researchers will still have a place to stay while working at Purchase Knob. Construction of these platforms, with volunteer labor, is scheduled for October of 2004. The lab, public restrooms, and office for the Research and Education Coordinators will remain in use throughout FY 2005.

OZONE EFFECTS MONITORING: Gardens to monitor the effects of ground-level ozone on known sensitive plants are now in their fourth year at the Purchase, Twin Creeks, and Tremont. These gardens are associated with on-going ozone effects studies by Dr. Howard Neufeld, Appalachian State University, Dr. Arthur Chappelka, Auburn University, Dr. Peter Finkelstein, EPA, Dr. Alan Davison, University of New Castle and two current Appalachian State graduate students. This year, the education portion of the garden research expanded from 11 to 36 sites. Each participating site is given at least five genetic clones of Cut-leaf Coneflower and/or Crownbeard from our garden to establish elsewhere, usually at a school or nature center. Two of these gardens, located in Morgan County, Tennessee, are being managed by staff from the Obed Wild & Scenic River who have been trained by Learning Center staff on how to collect data.

An internet database to support the data collected at all 36 garden sites was developed this year by Hands on the Land, a non-profit education consortium of five federal land agencies. The Hands on the Land site allows students to input their data and compare it to the data of another garden at a different location, http://www.handsontheland.org/monitoring/projects/ozone/ozone_bio_search.cfm. This website and the garden project were highlighted in four different teacher training workshops in 2004, 95 teachers received training on how to recognize and collect data on the visible symptoms from ground level ozone on sensitive plant species.

VOLUNTEER INTERNS: The Science Learning Center took on a number of volunteer interns this summer, providing the interns with training in research and/or presenting educational programs about

research, as well as getting valuable assistance for Park programs. Ashley Aspinwall (University of North Carolina-Ashville), Laura Lossier (Haywood Community College), Amy McIntire (Antioch College), and Megan Craig (Augusta Preparatory Day School) all completed formal internships for credit at their respective schools. They collected data on salamanders, birds, and a variety of invertebrates, as well as helped to present and evaluate education programs. Other volunteers have assisted with the operation of the Monitoring Avian Productivity and Survivorship (MAPS) bird banding station at the Purchase, writing species web pages for the ATBI, and with the development of a pictorial key for land snails. Volunteer high school student Alex Casella was interviewed on National Public Radio's Living on Earth while assisting with the moth inventory at the Purchase.

MONITORING AVIAN PRODUCTIVITY AND SURVIVORSHIP: The Smokies ran two MAPS bird banding stations during the breeding season of 2004. The Great Smoky Mountains Institute at Tremont ran its MAPS station for the fifth consecutive year, using local high school students as assistants. Their total of 73 birds captured, 33 of which were Louisiana Water thrush, reflects a partial recovery by the birds along the Middle Fork of the Little River after the flood event of spring 2003. At Purchase Knob, the MAPS station was in its third season, operated with the assistance of students from University of North Carolina-Asheville and retired biologist Les Saucier. The ten nets, run for six hours, eight mornings out of the summer, captured 369 birds of 36 species. These data will be sent to the Institute for Bird Populations in California as part of a continent-wide effort to monitor bird population trends. Fecal samples, ectoparasites, blood smears, and feather samples were collected from some birds for studies of parasites and population genetics.

ASSISTING OTHER PARKS: The mission of the Appalachian Highlands Science Learning Center includes service to the Blue Ridge Parkway, Obed Wild and Scenic River, the southern portion of the Appalachian Trail, and Big South Fork National River and Recreation Area, as well as Great Smoky Mountains National Park. Assistance to other sites includes initiating an inventory of land snails, slime molds, and moths for the Obed and assisting Big South Fork with the development of a seven school system educational partnership along the model of the partnership between Gatlinburg's Pi Beta Phi School and the Smokies. In addition, we hosted a national meeting of other Research Learning Centers, participated in a planning workshop for Acadia National Park's new Research Learning Center, and have been meeting with the Southern Appalachian Cooperative Ecosystem Studies Unit and the Appalachian Highlands Inventory and Monitoring Network to develop better ways of working together.

RARE PLANT MONITORING: Monitoring of 20 rare plant populations planned for this year did not occur due to lack of funding to hire a seasonal biological science technician to assist with data collection. This marks the first time in over a decade that no assistance was available. The populations included federal and state listed endangered species and other declining plants. Monitoring of 16 populations of American ginseng, a species subject to poaching, also did not occur this year for the same reason. This project is part of a multi-park effort to monitor poaching pressure on this long-lived perennial which is highly sought after in China. Prices for a pound of dry roots fluctuated between $300 and $400 this year. The Smokies is the largest "protected" population of this rare species anywhere, but illegal collection is difficult to stop, and has been shown to occur routinely in the Park.

WHITE-TAILED DEER & VEGETATION MONITORING: Thirty 10 meter x 10 meter plots were established in Cades Cove (1997) to monitor the effects of white-tailed deer on vegetation. Fiscal year 2004 marked the eighth year of monitoring to compare 15 fenced (or exclosed) plots to 15 unfenced, control plots. Although there does not seem to be changes in numbers of species between exclosed and control plots at this time, forest tree seedlings in exclosures have shown dramatic increases in height and number, and many herbaceous species are blooming for the first time since the exclosures were erected. The eight years of data are being analyzed at Michigan Tech University by Jennifer Griggs, a master's student, and Dr. Chris Webster, Jennifer's advisor. The Wildlife Branch of the Division makes regular counts of deer in the cove, and the two data sets are compared.

NEW PLANT RECORDS FOR THE PARK: In FY 2004, nine new plants were added to the park:

Kraal's sedge	*Carex kraliana*

Cumberland sedge	*Carex cumberlandensis*
Slender woodland sedge	*Carex digitalis* var. *macropoda*
Stolon-bearing hawthorn	*Crateagus iracunda*
Goat willow	*Salix caprea*
Southern arrowood	*Viburnum dentatum* var. *dentatum*
Palm-leaved grape	*Vitis palmata* (tentative ID)
Taylor's filmy fern	*Hymenophyllum taylorii*
Brazilian verbena	*Verbena braziliensis*

Only two of the new plant records are exotic species, the Goat willow and the Brazilian verbena. Both are roadside introductions, most probably by seeding mixes used by contractors working on roadside construction. The Taylor's filmy fern is listed by Nature Serve as a G1/G2, meaning it is considered a critically imperiled species, globally. The hawthorn tree discovery by Ron Lance (an authority on this group) and Janet Rock also turned up the largest population known for this southeastern tree.

POST EIS RAVENSFORD ISSUE: As a follow-up to the Ravensford Land Exchange EIS, Park Botanist Janet Rock has been researching the best way to transplant extremely rare lichen from the Ravensford tract. A lichen in the genus *Leioderma* was discovered during EIS work there that is only known from two trees. Repeated searches have failed to discover this species anywhere else in the park in similar habitat, and the thalli on one tree disappeared during FY 2004. We hold out some hope that other occurrences may be found of this species, but until the discovery at Ravensford, only one other *Leioderma* species in this genus was known from North America – another rare species from the Puget Sound area in Washington State.

The remaining tree is under the footprint of the planned construction at Ravensford. The Eastern Band of the Cherokee Indians has been extremely cooperative with park employees in trying to find ways to protect this new species. Transplantation of lichens has not been undertaken very often, and Janet is discussing with authorities worldwide, but prospects do not look good for success. During the year, Janet and natural resource managers for the Eastern Band of the Cherokee Indians have co-selected transplant sites, and the operation will occur in the next few months.

OTHER: Janet Rock worked closely with ATBI scientists to identify plant specimens that were host to various invertebrate groups during the year. She also assisted 80 mycologists from various states and other nations in the three-day MycoBlitz organized by Discover Life in America in July. The National Science Foundation supported the foray event that collected fungal fruiting bodies for identified vouchers, from which DNA analyses would be made.

Discover Life In America and the All Taxa Biodiversity Inventory

HIGHLIGHTS: Discover Life in America (DLIA) cooperates with Great Smoky Mountains National Park to conduct the All Taxa Biodiversity Inventory (ATBI), a survey of all forms of life in the park underway since December of 1997. Receiving support from Great Smoky Mountain Association, Friends of the Smokies, as well as individual and corporate giving, DLIA administers grants to scientists, organizes volunteers, coordinates development, and public relations, and assists Park Partners with education programs. For further information see http://www.dlia.org or contact Jeanie Hilten, Jeanie@dlia.org. The seventh ATBI Annual Conference (December 2-6, 2003) draws 140 attendees from 23 states. Dr. Peter Raven, Director Missouri Botanical Garden gave keynote address and there were 28 other presentations. Special pre-conference forum, "ATBIs at Other Reserves" had 26 participants, discussing methods for conducting ATBIs at other parks, forests, and preserves. (See Progress in Science, below, for a sampler of findings). DLIA Volunteers donated over 7,000 hours in 2003.

NEW STAFF: Discover Life in America welcomes new part time staff! Anne Ramsden (anne@dlia.org), Pamela (P.J.) Nabors (pj@dlia.org), and Chuck Cooper (chuck@dlia.org) Anne is Clerical Assistant, P.J. is Technical Assistant, and Chuck is Database Technician.

SPECIES TALLY: Bioquests yield new knowledge and more participation between volunteers and scientists. Total participation of all events during the 2004 research season: 310 researchers and 452 volunteers. The Taxa Tally as of August 2004 is 516 species new to science plus 3,314 new records for the Park.

ATBI EXHIBIT AT SUGARLANDS: A new exhibit at Sugarlands Visitor Center features lovely paintings of ATBI flora and fauna by DLIA volunteer Nancy Lowe. Scott Pardue and Cathy Cook of Resource Education organized the exhibit and the Reception for the artist on February 27.

ATBI UNDERWAY IN TENNESSEE STATE PARKS: Chuck Cooper, DLIA interns, Chuck Parker, Becky Nichols, Shelaine Curd-Hetrick, and Jeanie Hilten presented sessions at their August 12-13 meeting. Tennessee State Parks has just hired a scientist to help their staff coordinate their efforts at several state parks.

ATBI PROGRESS IN SCIENCE: A sample of some interesting findings from 2003 DLIA Grant reports:

- Surveys of tardigrades (water bears) on all 19 ATBI plots show 49 species, 46 of which are new park records and 8 of which are new to science. (Paul Bartels, Warren Wilson College)
- Thirty-three trails in 11 areas of the park have been mapped for ferns. This covers over 100 miles. (Patricia Cox, formerly University of Tennessee, now TVA))
- Three new records of vascular plants have been found in the park, along with numerous rare plant populations. (Paul Marcum, Ill. Natural History Survey)
- Over 2500 small rodents and insectivores have been trapped and released since Oct. 1999. (Ed Pivorun, Clemson University)
- The plant hopper and leafhopper survey found 35 new park records; 138 species of leafhopper and 77 species of plant hopper. (Charles Bartlett, University of Delaware)
- Original lists of beetles in the park show 804 species. As of August 2004, there are over 1,600 species. (Chris Carlton, Louisiana St. University.)
- The fish snorkeling work done as part of the Vertebrate Study covered 65 sites in 20 streams. Fifty-two species were observed, of the 79 that have been known from the park. Sixteen past records are from the now inundated Abrams Creek embayment and most likely extirpated. (Pat Rakes)
- 151 bacteria have been isolated from samples: 92 are possibly new to science, and 59 are possibly new park records. Seven archaea sequences were detected: Six new to science and one new park record. (Sean O'Connell, Western Carolina University)
- A total of 89 streams, 18 seeps and springs have been sampled for Oligochaetes (aquatic worms) with 4 new state/park records. (Mark Wetzel, Ill. Natural History Survey)
- 70 permanent reptile sampling sites were established as part of the Vertebrate Study. 1,123 individuals of 33 species were encountered. Two new retiles for the park are the "Stinkpot" turtle and the Cumberland slider. Interesting finds: hognose snake, mole king snake, eastern milk snake. (Ben Cash, Maryville College)
- Algal records for the park now total 579 species. An NSF grant has been obtained to continue to identify and study the Park's algae. (Rex Lowe, Bowling Green St. University, and Jeff Johansen, John Carroll University.)
- 50 species of tephritid flies have been found in the park. Two are new to science and 38 are new park records. Previously, there were only 3 species represented in the Sugarlands collections. (Bruce Sutton and Gary Steck, Florida State Museum)

DLIA SCIENCE COMMITTEE AWARDS 2004 GRANTS:

Congratulations to 15 recipients of the 2004 DLIA Grants! New and continuing research will be conducted on a variety of species including ants, tardigrades, micro-fungi, leaf beetles, moths, lichens, and more. Also funded are several educational workshops, bioquests, and a teacher internship. Final Reports and geo-referenced data are in for almost all of the 2003 DLIA Grant recipients. A total of 7,120 hours were donated (in addition to volunteer hours reported above); $91,056 in-kind resources donated; $67,791 in leveraged funds (with others pending)

- Paul Bartels, Warren Wilson College: Continued Inventory of Phylum Tardigrada Richard Baird, Mississippi State University: Microfungi of American Beech, Fraser fir, and Eastern hemlock,
- Matthew Dakin: Survey of the Suborder Caelifera
- Colin Favret, Center for Biodiversity, Illinois Natural History Survey: *Expanding our Knowledge of the Aphids of the Park*
- John B. Heppner, Florida State Collection of Arthropods: *Biodiversity of Day-flying Micro-moths of Great Smoky Mountains National Park.*
- Harold Keller, Central Missouri State University: *Lichen Bio-Quest in Great Smoky Mountains National Park*
- Paul Marcum, Center for Wildlife and Plant Ecology, Illinois Natural History Survey: *Search for New and Rare Vascular Plants and Lichens*
- Michael Pogue, Smithsonian Institution: *Noctuidae (Lepidoptera) of Great Smoky Mountains National Park.*
- Edward Riley, Texas A & M University: *Continuation of Leaf Beetle Inventory*
- Nathan Sanders, University of Tennessee: Ant Diversity in Great Smoky Mountains National Park
- Brian Scholtens, College of Charleston: *Lepidoptera BioBlitz 2004*
- Charles Staines: Inventory of Five Families of Beetles (Insecta: Coleoptera) in Great Smoky Mountains National Park.
- Gary Steck and Bruce Sutton, Florida Department of Agriculture: *Tephritid Flies of Great Smoky Mountains National Park*
- Paul Super, Great Smoky Mountains National Park: Teacher Enrichment Internship
- Mark Wetzel, Center for Biodiversity, Illinois Natural History Survey: To Continue an Inventory of Freshwater Oligochaeta (Annelida) in Great Smoky Mountains National Park.

BIO-QUESTS IN 2004: 4 Fern Forays, Lichen Workshop and BioQuest, Noctuid Moth Workshop and Bio-Quest, Myco Blitz, Slime Mold Workshop and Bio-Quest, Lepidoptera Quest, Leaf Litter Blitz. The July Lepidoptera Quest resulted in identifying 795 species and finding 9 species new to science and 24 new park records. More than 500 mitochondrial DNA vouchers were produced**.** (See article in the summer *ATBI Quarterly*). The July Myco Blitz brought together about 70 scientists and identified over 200 species of fungi. This number will increase greatly as researchers get back to their labs. (See article in the summer *ATBI Quarterly*). The August Leaf Litter Blitz was the first event of its kind for the ATBI in the park. 8 scientists and 16 volunteers searched the rich humus layer of the forest for a variety of soil organisms. 36 samples were collected, and after all are run through Berlese funnels, may yield as many as 3,000 arthropod specimens. Chris Carlton states that a new species of the ground beetle genus *Anillinus* was found. Dan Dourson found an undescribed land snail. (Read more in the upcoming Fall *ATBI Quarterly*).

DLIA provided ATBI housing for 1,148 person/nights from January—September 2004, allowing researchers lodging at the Cades Cove, Cosby, and Cosby Campground houses, (which are rented from the park). Highest occupancy month was June with 325 person/nights. Anne Ramsden, DLIA clerical staff, does an excellent job of keeping the calendar up to date and contacting researchers with lodging information.

ATBI PROGRESS IN EDUCATION AND VOLUNTEER ACTION: In science education, curricula and field methods have been developed for 3rd grade through high school (our future scientists!), with students and teachers making real contributions. 2,680 Pi Beta Phi Parks as Classrooms students did ATBI projects and studies have shown that the hands on field work has assisted with an increase in achievement in other academic areas; 950 high school students did activities at Appalachian Highlands Science Learning Center. 6 projects of the 16 Upward Bound Math and Science Programs were ATBI related. Tremont's teacher internship centered on ferns, the Beetle Blitz, snails, and moths. Since 1998, the Tremont moth inventory has collected 13,050 individuals, with 634 species and over 120 new park records. Most moths are collected in a customized refrigerator and released.

(Thanks to Judy Dulin, Jonathan Mays, Paul Super, Susan Sachs, Michelle Prysby, and Mike Maslona).

- "Wilderness Volunteers," an organization that coordinates service projects in various parks, brought 12 volunteers from across the United States for their third year working on ATBI activities. With DLIA science/taxonomy project team leader Jim Lowe, the group conducted a fall flower foray and took down equipment from the Andrews Bald ATBI plot.

- Volunteer photographers, scanners, and artists contributed their works to the "Documenting Life" collection of ATBI images for a special exhibit at Sugarlands Visitor Center. The pictures, in particular the high resolution scans, give a surprising portrayal of the small creatures being inventoried. The beauty and complexity of life forms are well shown when a tiny creature or plant is blown up to a colorful 16" by 24" poster!

- Shelaine Curd-Hetrick is developing a new web-based form for more effective information-gathering about ATBI programs and products. This will allow anyone who leads classes, talks, or presentations, or develops curricula, websites, or other materials to let us know about it through the web.

- Volunteer Jim Burbank is compiling a new Volunteer Field Manual. This will be used in training volunteers for a variety of work in the field and the lab. Sections include backcountry safety, use of GPS in the park, collecting methods, setting up traps, preparing labels, and protocols for trail surveys and bio-quests.

- DLIA Board member Rebecca Shiflett rpshiflettphoto@usit.net led a Photography Team meeting March 11. Plans were made for photographic needs for the 2004 season.

- We appreciate scientists and park staff who offer their time and expertise to teach classes for our "Citizen Scientists." This summer, there were workshops and other educational sessions as part of all Bio-Quests and Blitzes!

- DLIA Interns Jessica Hoffman and Jessica Brown were a great help during the summer with a variety of projects: assisting with Fern Forays and Bioquests, writing a "How To" guide for ATBIs, helping with Kris Johnson's vegetation crew, presenting ATBI talks to community groups, and participating in workshops and training.
- The Education Committee is working on several projects, including "Biodiversity Boxes," grant proposals, and program development for the park, schools, and citizen science. An EPA grant for $21,000 was obtained for a Slime Mold Workshop at Tremont June 2-5, 2005. Good work! A proposal to the National Science Foundation for an Informal Science Education grant is in the works. The letter of intent is due November 5, 2004, and the full proposal is due in January 2005.
- Since 2000, Discover Life in America has trained over 300 volunteers.
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PROGRESS IN IT/COMMUNICATIONS: The DLIA website http://www.dlia.org is more easily updated by DLIA staff and partners, with help from staff at NBII/SAIN and the use of "Contribute" software to upload pages. There will be a revised structure and format for the website online by November, 2004, thanks to Joe Henderson, Franciel Azpurua-Linares, Shelaine Curd-Hetrick, P.J. Nabors, and Jeanie Hilten.

The *ATBI Quarterly* is available online and in color at http://www.dlia.org/atbi/press/quarterly.html. Go to this page or click on the link on the home page to subscribe to be notified when a new Quarterly is available. CDs of various power point presentations are available for those interested in giving talks about the ATBI. Contact Jeanie Hilten.

DLIA Database Technician Chuck Cooper has been working with scientists to obtain data from a variety of reports including the Vertebrate Study and DLIA grants. He has improved the Fern Foray database, answers questions from scientists about data formats, enters geo-referenced data during

Bio-Quests and Blitzes, helps Michael Kunze and Chuck Parker with the ATBI interim desktop database, and is developing a web entry form for ATBI data. On Tuesday, December 7 there will be a morning workshop on ATBI Database/GIS at the Glenstone Lodge in Gatlinburg, Tennessee. To find out more about this free class, contact Chuck Cooper, 865-430-4756 or chuck@dlia.org.

DLIA Technical Assistant P.J. Nabors has set up standards and protocols for our high-resolution scanner and for the DLIA Image Database (Cumulus). Scanned images are saved to disc, choice ones are cleaned up by volunteers in Photoshop, and then they are entered into the database. 111 creatures and plants have been scanned since May, 2004. P.J. is completing species pages on the website. Over 140 bird pages, written by Paul Super and Appalachian Highlands Learning Center interns, are online. Templates are being revised and finalized for other taxa, including updates to the vertebrate species pages, new pages for insects, a species new to science page, and more plants. Have a look and contact P.J. at pj@dlia.org.

PROGRESS IN DEVELOPMENT: Friends of the Smokies sold several of the prints from the high-resolution scanner at their fundraising auction. These beautiful prints of the tiny but fascinating life forms of the ATBI continue to draw interest. Other ways to market the images are being explored by the Development Committee, the Friends, and Great Smoky Mountains Association.

Individual donations for January-September, 2004 total $5,581. Thank you, supporters of DLIA! We appreciate Nan Jones and Ellie Burbank keeping up with the DLIA donor database at the Friends of the Smokies office. Other income as of September, 2004: $7,155.07 in promotional items (T-shirts, mugs, mouse pads) sold by Great Smoky Mountains Association at the Park Visitor Centers; $414.70 in honoraria from talks given by DLIA and Park staff; $580.00 in housing reimbursements; $107,402.98 in Partners' contributions to date (Friends of the Smokies and Great Smoky Mountain Association)

DLIA LAST WORDS: FY 2004 (October 2003—September 2004) has been productive for All Taxa Biodiversity Inventory projects, especially considering these lean times for resource protection and science. The growing involvement of researchers and the contributions of volunteer time and expertise enhance every aspect of our program. With the addition of part-time Discover Life in America staff to support ATBI data and management, office help, and the website (with NBII/SAIN), progress is being made in these infrastructure components. Education partners continue to carry the message of discovery and preservation of biodiversity out into wider and wider audiences. Although we will have to keep tightening our belts in 2005, everyone's dedication to excellence, leadership, and hard work will keep the ATBI going till it is completed!

VEGETATION MANAGEMENT – Kris Johnson (865-436-1707)

HEMLOCK WOOLLY ADELGID: The hemlock woolly adelgid (HWA) control project was greatly expanded in 2004, largely due to financial support from the Friends of the Smokies and the U.S. Forest Service. A full-time coordinator and four subject to furlough forestry technicians were hired in April. HWA surveys were conducted throughout the park concentrating on the nearly 800 acres of old growth and 18,000 acres hemlock dominated areas. Unfortunately, infestations were identified in all areas of the park, although there are still areas where HWA has not been seen. We have yet to see large-scale hemlock mortality in the park.

Necessary equipment was purchased including:

- Polaris Ranger w/ 100-gallon Slip-on Sprayer: Used to foliar treat administrative roads and some backcountry areas depending on trail restrictions. Spray height is 35 feet.
- Chevrolet 3500 four-wheel-drive pick-up truck with slip-on sprayer: Used to foliar treat heavily visited, developed and roadside areas. Spray height is 45 feet.
- Ford F-550 pick-up truck with slip-on sprayer: Used to foliar treat heavily visited, developed and roadside areas. Spray height is 85-90 feet.

- Arborjet Inc., through the Friends, donated $4,200 in trunk injection equipment, which will allow treatments to be made in riparian areas.

Control activities included foliar treatments with insecticidal soap and systemic insecticides applied through the soil or stem of individual trees. Total area treated in 2004 was over 900 acres. Some of the highlights include:

- Cades Cove: Twenty-five percent of the loop road has been treated. Campground, ranger station, and historic areas have been treated.
- Tremont: Entrance road and administrative portion of middle prong trail has been treated. Developed areas, including the Institute, have been treated.
- Elkmont: Campground and historic areas completed.
- Greenbrier: Roads, accessible trails and developed areas completed.
- Cosby: Roads, accessible trails, campground and developed areas completed.
- Oconaluftee: Roads, accessible trails and developed areas completed.
- Deep Creek: Campground and developed areas completed.
- Cataloochee: Campground, group camp, horse camp and accessible roads completed.

There were fourteen releases of the biological control, ladybird beetle *Sasajiscymnus tsugae,* totaling 32,983 beetles. Release site included Albright Grove, Middle Prong of Little Pigeon River, Cades Cove/Tipton, Brushy Mt. Trail, Grotto Falls Trail, Bullhead Trail, Lead Cove, Deep Creek Trail, Cades Cove/Rabbit Creek, Deep Creek Trail, Cades Cove/Arbutus, Chimney Tops, and Gregory Ridge Trail. Monitoring of past release sites was conducted in 2002 and 2003. It is still too early to predict the affect these beetles are having on HWA infestation.

In June 2002, the park initiated a program to control HWA by introducing a ladybird beetle (*Sasajiscymnus tsugae*) that feeds exclusively on HWA. Beetles have been released at 23 sites throughout the Park. Beetles were released in mass quantities (2500 – 5000 beetles per site) at 8 sites in 2002, 7 sites in 2003, and 8 sites in 2004. Dr. Paris Lambdin of the University of Tennessee completed monitoring at the 2002 release sites. Monitoring included examining tree health, HWA densities, and beetle presence at the release sites. They detected ladybird beetles at three sites. Tree health monitoring data was not conclusive in this short study. This spring, NPS Biological Technicians completed monitoring for the 2002-2003 beetle release sites. At each site, the original release trees were monitored for general health, HWA density, and ladybird beetle presence. We used a U.S. Forest Service index for assessing overall tree health and for assessing HWA density. We did not find any adult or larvae ladybird beetles at the 15 sites. We did find other adult and larvae Coccinellid beetles, but we did not detect any S*. tsugae.* A low recovery rate of beetles is common in a forested environment where beetles could presumably disperse into the canopy of surrounding large trees. Most (70 percent) of the sites exhibited high HWA densities, while most (70 percent) sites exhibited hemlocks in 'Fair' condition. Average dieback among the release trees was rated at less than 10 percent per tree at 13 sites. Average crown density (range 20 – 40 percent), foliage transparency (range 40 – 80 percent), and live crown ratio (range 68 – 97 percent) ratings are within a range of values that is typical for healthy hemlocks under canopy. We expect these values to dramatically change if trees become stressed and suffer branch dieback and loss of foliage. In general, hemlock trees at the release sites are in fair condition (foliage somewhat off color &/or thinning crowns) and adelgid populations are high (total branches on tree are >50 percent infested). Data collected this year does not allow us to infer any indication concerning the success or failure of the program. We will continue this monitoring at beetle release sites this fall and next spring. This baseline data will allow us the ability to detect large changes in the community to better evaluate the beetle release program.

OTHER FOREST INSECT AND DISEASE MANAGEMENT ACTIVITIES: The gypsy moth trapping program was once again successful in the Park. A total of 129 traps were set out in May, in cooperation with the USFS – Forest Health unit in Asheville. No gypsy moths were found during the mid-check in July or the final check in late August. This makes three years in a row with no positive catches! With so many forest pests threatening our resources here in the Smokies, let us hope the gypsy moth will continue to remain out of the park.

The surviving Fraser fir at high elevation peaks remain in relatively good health. With the exception of Mt. Sterling, nine of the ten study sites show vigorous new growth, and little to no adelgids present. Regeneration in all of these areas is growing at a rapid rate, leaving great hope for survival of future stands. We are awaiting results of bark sample analysis from North Carolina State University, determining hormone levels which could be a factor in possible adelgid resistance in the mature fir. We will continue to monitor these areas each year, and remain positive for the hope of our mature fir to not only survive, but continue to reproduce.

Balsam woolly adelgid infestations were treated with soap spray at Balsam Mountain Road and the genotype preservation plantation at Purchase Knob.

A preliminary survey for the presence of Sudden Oak Death (S.O.D.) was conducted during the month of September, using U.S. Forest Service protocols for plot layout as well as plant tissue and data collecting. Four 100m transects were surveyed at each of ten sites along park boundary areas, which contained host species of the pathogen *Phytophthora ramorum*. Suspect leaf and bark tissue was collected from host species along transects, and shipped to Mississippi State University for analysis. Results are pending, and will be included in a later report. Special emergency funding was received for this project, which was conducted in cooperation with state agriculture agencies. In March 2004 infected plant materials were shipped from a large California nursery to many eastern states; surveys concentrated on areas near plant nurseries and newly landscaped developments.

INVASIVE PLANT MANAGEMENT: In calendar year 2004 through September, the Great Smoky Mountains National Park Vegetation Management Crew worked 980 hours on exotic plant sites. This work covered nine hectares (22 acres) and brings the active site tally to 818 documented sites. A significant drop in treatments occurred this year due to budget shortfalls. Total number of treatments as of September 2004 was 90 as opposed to 272 total in 2003 and 305 total in 2002. Prioritization of sites was determined by invasive characteristics of species, access to the location of the site and available personnel. Two wildland fires, Sharp and Green Mountain, covering close to 8,000 acres, were surveyed and treated using BAER funding for wildfire rehabilitation. The funding for these projects expires in FY 2004. Preliminary conclusions confirm that invasive species such as Paulownia *(Paulownia tomentosa),* Mimosa *(Albizia julibrissin)* and Tree of Heaven *(Ailanthus altissima)* take full advantage of wild land and even prescription fires, now rich in nutrients and open crowns, to displace native communities. Paulownia removed from the Green Mountain fire in 2004 totaled 785 plants and for the Sharp Fire 325 plants. A total of 214 Paulownia were removed from the Tabcat prescribed fire, 261 from the Blacksmith wild fire, and 27 from the Wedge Ridge prescribed fire. It should be noted that the majority seed source of these exotic species is external from park boundaries. A large Tree of Heaven site was discovered just outside the Blacksmith fire site boundary, at an old home site. Over 400 trees were removed from the two acre site, where five trees exceeded 12 inches in diameter and one large 36 inch diameter tree was found, probably the parent tree. This is further evidence of how when left untreated, invasive species can completely displace native re-vegetation in the old home sites in the park.

31,116 Garlic Mustard *(Alliaria petiolata)* plants were pulled at five different locations in the park. The amount in 2003 was only 13,271. This is due to the biennial dynamics of the plant and also a new infestation discovered in 2002 proved to be much more extensive after further scouting. The abundant seeds of this plant spread over five miles downstream on Fighting Creek from the gap almost down to Sugarlands Visitor Center. A large new infestation of exotic knapweed was treated at Purchase Knob.

Inactive Kudzu sites made a small resurgence in some areas of the park and were discovered through monitoring protocols. All inactive exotic species locations are monitored every 3-5 years to ensure they do not become re-established. Management treatments included foliar spraying, cutting/spraying, annual cutting, pulling, and monitoring and database management.

CADES COVE MEADOW RESTORATION: This year there were no fields burned in Cades Cove for the meadow restoration effort. However, we were still able to conduct our first 2-acre meadow restoration no-till seed planting on May 26, 2004. One hundred fifty-five bulk pounds of native grass

seed were planted on a two-acre parcel in the old cattle lease between Maple Brand Abrams Creek. A one-acre discing experiment was also done at the suggestion of University of Tennessee's Craig Harper. Both of these areas are being monitored for invasive species and success of the establishment of the natives. Approximately 100 acres of fields heavily infested with serecia lespedeza were treated with herbicides this year. Control of both Johnson grass and bull thistle continued.

In FY 2005, the park will move from two-year to three-year rotational burn/mow plan for all of the interior fields in the cove. We have begun to do the mowing of the fields with our own new equipment instead of contracting out the job.

Twenty-four thousand live plants were planted in the increase fields this spring. Species include: little bluestem, big bluestem, Indian grass, gamma grass, bushy bluestem, tall beard grass, and round-headed bush clover. Ten thousand plants were from the National Plant Materials Center in Maryland and 27,000 were produced here in our greenhouse at Twin Creeks.

We are currently preparing for our first fall planting of plugs in the increase fields. We will be planting 13,000 plugs of big and little bluestem.

GRASSY BALDS RESTORATION: Three backcountry camping/work trips were made in FY 2004 to continue restoration of Gregory Bald by removing encroaching woody vegetation. One trip was made to perform similar work at Andrews Bald.

INVENTORY AND MONITORING: Integrated Pest Management calls: six consultations and/or on-site visits for rodents; two for hornets - one of which turned out to be virtually harmless cicada killer wasps; surveying and control of fire ants at Cades Cove - Hyatt Lane and trail crew barn area (inactive), Riding Stables (active).

Annual balsam woolly adelgid (BWA) population densities were monitored on four mountain tops. BWA densities on monitor trees at Clingmans Dome, Mount LeConte and Mount Sterling remain low, while Balsam Mountain monitor trees had lower BWA densities than last year. Also at Balsam Mountain, pockets of high BWA densities required insecticidal soap treatment in July.

Beech bark disease on American beech was monitored in 2004. Analysis of ten plots is not complete but anecdotal observations appear to show a plateau in total beech mortality with two sites showing continued growth of root sprout saplings.

GREENHOUSE AND PLANT SALVAGE: Greenhouse production and plant salvage operations this year centered on three major projects: Cades Cove meadow restoration, vegetation screening at Mt. LeConte, and plant salvage for the Straight Fork Bridge construction zone. In the greenhouse, we produced thousands of plant plugs specifically for meadow restoration efforts in Cades Cove. Of the seed harvested in the fall of 2003, we processed, stratified, and successfully grew plants of nine forb species and three grass species. Overall, we produced 16,736 grass plugs and 1,026 forb plugs for meadow restoration plantings in the Cove. Additionally, we produced plants for efforts at Mt. LeConte to use native vegetation to visually screen an unsightly propane tank storage area. In late summer of 2003, we collected seeds from Mt. LeConte from a variety of native species. This winter we produced 750 plugs of bush honeysuckle, mountain ash, and snakeroot for planting. We planted these plugs in August in a grassy area in front of the propane tank complex. We are hopeful that these plants will provide a natural buffer that visually screens this area so that it is not an eyesore for park visitors. Finally, we salvaged plants from a future construction site where the Straight Fork Bridge will be built next year. We collected 75 plants from a variety of 20 different species at the site. We identified a total of 38 different species that could likely be salvaged before construction begins. We hope to continue these efforts so that we may salvage as many existing plants from the site as possible before the area is disturbed. We are holding these plants at our shade house until the new bridge is completed. We will replant these plants during the appropriate season following the completion of the bridge.

PRESENTATIONS:

- Glenn Taylor: Leadership Sevier (forest pests), Pittman Center town meeting (homeowner treatment for hemlock woolly adelgid), Great Smoky Mountains National Park Commission (HWA), plus two presentations to the park management team and one to Tennessee foresters regarding Park HWA management plans. A presentation of the forest pest component of the Park's Inventory and Monitoring program was given to an NPS Inventory and Monitoring evaluation team.
- Steven Shaper: Townsend Kiwanis Club, Experience your Smokies Blount County, Wilderness Wildlife Week (Cades Cove Restoration)
- Kris Johnson: Wilderness Wildlife Week, University of Tennessee Forestry classes, Knoxville Garden Club, Keep Blount County Beautiful, Southern Appalachian Forest Entomologist and Pathologist Seminar, UT/TN Department of Forestry Gypsy Moth Review, International Society of Arboriculture, Wildflower Pilgrimage (field trip and auditorium lecture), Leadership Sevier, Friends of Oak Ridge National Lab, Tennessee Agricultural Extension and Division of Forestry.
- Scott Kichman: Society of American Foresters, Asheville, North Carolina - "Aliens in our National Parks," Haywood Community College, Clyde, North Carolina – "Vegetation Management in the Great Smoky Mountains National Park", Southern Appalachian Entomology and Pathology Working Group, Crossnore, North Carolina- "Hemlock Woolly Adelgid Management in Great Smoky Mountains National Park"
- Cherie Cordell: Lincoln Park Elementary School (Knoxville inner city), University of Tennessee horticulture classes
- Marion Kloster: Tremont College Consortium Tom: Public meetings for hemlock woolly adelgid

<u>WILDLIFE MANAGEMENT</u> – Kim DeLozier (865-436-1248)

WILD HOG CONTROL: Since January 2004, 136 wild hogs have been removed from the park; this number is expected to approach 200 by the end of the calendar year. By request, we provided the North Carolina Department of Agriculture and Consumer Services, Veterinary Division with 14 wild hog serological samples as part of their monitoring program for psuedorabies, swine brucellosis and classical swine fever. We also provided technical assistance to Big Thicket National Preserve and presented a case study at a wild pig symposium.

BLACK BEARS: Wildlife personnel responded to over 125 bear reports, covering 54 different locations throughout the park. Bear warning signs were posted at 22 locations. Four backcountry campsites and Tremont Road were temporarily closed due to bear activity. Wildlife staff handled 21 bears associated with nuisance activity; six of these bears were relocated outside of the park. One bear was euthanized due to aggressive/predatory behavior. Several bears were in very poor condition due to a poor acorn crop during fall 2003. Two yearling bears and one adult female were taken to the Appalachian Bear Center due to their poor physical condition; one of the yearlings was released back into the park in September and the others will be released later in the fall. Wildlife staff continued the use of non-lethal techniques such as aversive condition on bears, conditioning them to avoid people. Several food storage cable systems were also repaired. The black bear bait-station survey was conducted in July. Percentage visitation by route ranged from 27.8 percent to 100.0 percent. Overall percentage visitation was 66.3 percent which is slightly lower than 2003 (67.6 percent). The hard mast survey was completed in August. Results indicate fair white and red oak production although there were differences in North Carolina and Tennessee. Acorns were more plentiful in North Carolina and survey results suggested good production in North Carolina. Bear researchers from The University of Tennessee completed their 36th year of ongoing field studies on black bears. They captured 24 bears during 505 trap-nights and determined a population estimate of 260 bears for their study area which was slightly higher than their 2003 estimate (215 bears). They also completed their second field season of a pilot hair DNA study to determine population estimates.

ELK: No additional elk were brought into Great Smoky Mountains National Park in 2004. During 2004, most elk movements have been confined in or near the park; these areas include Balsam Mountain, Oconaluftee, Cherokee Indian Reservation, and White Oak although one elk, female #42, was located as far as Franklin, North Carolina. We documented the birth of eight calves during 2004; several adult females were not pregnant. There are currently two calves in Cataloochee valley, three calves in the White Oak area, one calf on the Blue Ridge Parkway, and one calf in Cherokee. There is a possibility that there are a few calves we have not located, but we should be able to document all live calves by this winter. We also documented the deaths of four male (#43, 50, 62, 30) and three female (#35, 53, 63) elk. The primary source of mortality was parasite related, however, one animal was euthanized due to potential conflicts on private land, and another died from complications associated with capture and handling.

ENDANGERED INDIANA BATS: Wildlife staff worked with the fire management staff and maintenance staff to consult with the U.S. Fish and Wildlife Service regarding potential impacts of prescribed fires, science center construction, and hazard tree removal on the Indiana bat. Summer mist netting was conducted by researchers from Clemson University in previous documented capture sites; however, no Indiana bats were captured.

ENDANGERED NORTHERN FLYING SQUIRREL: During winter, the wildlife staff and North Carolina Wildlife Resources Commission staff completed a nest box survey to monitor populations of endangered northern flying squirrels in the park. Fourteen northern flying squirrels were captured in three locations as part of the survey; two of these animals were recaptures. Wildlife staff worked with the fire management staff to consult with the U.S. Fish and Wildlife Service regarding potential impacts of the proposed Gregory Ridge prescribed fire on northern flying squirrels.

WHITE-TAILED DEER MONITORING: As part of the Cades Cove white-tailed deer monitoring program, wildlife staff completed distance sampling during winter. Scott Bates, wildlife biologist with the National Capital Region provided technical assistance in analyzing distance data. The preliminary deer density estimates for Cades Cove in 2004 is 0145 deer/hectare.

RABIES: An Iowa woman became the only known person ever to be bitten by a rabid animal in the park. The woman was hiking on the Old Sugarlands Nature Trail when she was bitten by a bat which later tested positive for rabies. According to reports, the women was hiking with a group of a dozen people when the bat began flying erratically around her and eventually landed on her fanny pack. She apparently contacted the animal with her elbow and received a small puncture wound on her left elbow. Other members of the group were able to catch and kill the bat and bring the carcass to the Sugarlands Visitor Center. Rangers were not certain she had actually been bitten, but advised her to seek medical treatment which she did in Haywood County, North Carolina. She elected to begin receiving a series of injections immediately to prevent rabies, even though the results of rabies testing on the bat were not yet in. Park biologists took the bat to the Sevier County Health Department for testing which was positive for rabies. The park has been testing certain bats that have turned up dead or acting suspiciously in high human use areas to be tested for rabies, but this is only the third one to come back positive. The park is working with public health officials and USDA Animal and the Plant Health Inspection Service to begin an Oral Rabies Vaccine (ORV) Program aimed at controlling rabies in raccoons throughout the region.

AIR QUALITY – Jim Renfro (865- 436-1708)

MONITORING: Long-term monitoring for visibility, fine particles, ozone, trace gaseous pollutants, dry deposition, wet deposition, cloud deposition, mercury, meteorology, and UV radiation continued at the park during the 2004 season. The park has seven air quality stations that monitor levels of air pollution continuously. Numerous agencies cooperate to collect the monitoring data, including the National Park Service, Tennessee Valley Authority, Environmental Protection Agency, States of Tennessee and North Carolina, National Oceanic and Atmospheric Administration, University of Tennessee, and University of Georgia. The park's air quality monitoring program collected

approximately 10 million measurements during the 2003 field season. Scott Berenyi (NPS), Bob Stroik (NPS), Don Ho (EPA Clingmans Dome contractor and Look Rock VIP), Bryan Pynn (summer SCA), and Bill Hicks (air contractor for Cove Mountain and Look Rock) were instrumental in operating and maintaining one of the most sophisticated air monitoring programs in the U.S.

IMPROVING TRENDS: Air quality across most of the important areas of concern at Great Smoky Mountains National Park is improving. Fine particle concentrations, visibility on the haziest days, ozone concentrations, and acid rain are all significantly improving over the past five years. The park's air quality is a long way off in restoring and remedying the problems, but it is very encouraging to see these improvements due to more favorable weather conditions along with emission reductions.

DATA ACCESS: air quality data can be obtained at:

- Ozone and Weather: http://12.45.109.6/pls/portal30/get_input.show_parms
- Visibility and Fine Particles: http://nadp.sws.uiuc.edu/
- Acid Precipitation: http://vista.cira.colostate.edu/improve/
- Dry Deposition: http://www.epa.gov/castnet/data.html
- Mercury: http://nadp.sws.uiuc.edu/mdn/
- UV radiation: http://oz.physast.uga.edu
- Forecasting and Mapping: http://www.epa.gov/airnow/ozone.html
- Real-time data: http://www2.nature.nps.gov/air/webcams/parks/grsmcam/grsmcam.htm
- http://www2.nature.nps.gov/air/webcams/parks/grsmpkcam/grsmpkcam.htm

The real-time air quality web sites continue to receive many "hits" each week and are one of the most popular websites on the NPS NatureNet. Nearly 100,000 visits to the site are recorded each week. Jim Renfro made a presentation at the annual Air Quality Conference held in Baltimore, Maryland this year on February, 24, 2004. The presentation on the uses of real-time webcams can be viewed at: http://www.epa.gov/airnow/2004conference/tuesday/renfro.pdf

PRESENTATIONS: Numerous presentations were made by the air quality staff to a variety of audiences throughout the year including the media, schools/universities, scientists, decision-makers at all levels, staff, and public.

ENVIRONMENTAL IMPACT STATEMENTS: Park air quality staff is involved in several on-going EIS's assessing the potential impacts of emissions on air quality from proposed projects (e.g. Cades Cove transportation plan, North Shore Rd, Foothills Parkway, and Straight Fork Bridge). Links to the North Shore Road EIS and Cades Cove Opportunities web sites are: http://www.northshoreroad.info/, http://www.cadescoveopp.com/

CRITICAL LOADS WORKSHOP: Jim Renfro attended a workshop in the Denver, Colorado the week of March 29, 2004 along with air quality experts from the U.S. Forest Service and U.S. Fish and Wildlife Service to continue to develop a critical loads framework to help protect acid sensitive ecosystems. A summary report of the workshop should be posted in the fall of 2004 on the following AIRWEB site: http://www2.nature.nps.gov/air/Pubs/index.htm

OZONE NON-ATTAINMENT: On April 15, 2004, EPA designated the entire park as non-attainment for the 8-hour National Ambient Air Quality Standard. The park ozone monitoring stations exceed the standard each year. The State of Tennessee has until June of 2007 to submit a State Implementation Plan to EPA and must be meet the standard (or be in attainment) by June 2009. The park had only 3 exceedances of the 8-hour ozone standard in the 2004, well below the average of 18 per year, but still high enough to continue to be out of compliance for the 2002-2004 seasons at most park monitors (Look Rock, Cove Mountain, and Clingmans Dome). Information about the 8-hour standard implementation can be found at http://www.epa.gov/ttn/naaqs/ozone/ and http://www.epa.gov/ttn/naaqs/ozone/o3imp8hr/

AIR QUALITY FORECASTS AND ALERTS: Jim Renfro attended a 2-day air quality forecasting meeting on April 22-23, 2004 with representatives from the State of Tennessee, TVA, National Weather Service, and local programs (Knoxville, Chattanooga, Nashville, and Memphis). Information

was shared on how the forecasts will be issued this year and how the air quality action day programs still be worked on. Jim participated in a media event/meeting on May 3 in Knoxville to brief the local TV, radio and print media on this region's "Air Alert" program for this summer.

The State of Tennessee and North Carolina resumed forecasting ozone pollution on April 30 for the Great Smoky Mountains National Park and region. These 2-day forecasts are issued daily and updated at 3 p.m. each day. Starting October 1, 2004, the State of Tennessee will continue to forecast year-round and not discontinue like year's past. They'll focus on particulate matter levels which can have higher air quality health indexes in the winter than ozone levels. The forecasts can be viewed at the following EPA "AIRNOW" web site.
http://www.epa.gov/cgibin/airnow.cgi?MapDisplay=FOREMAP

PASSIVE OZONE MONITORING STUDY: Park staff in the air quality branch participated in a passive ozone study with Blount County this summer starting May 11. The Blount County Community Health Initiative Air Quality Action Team received a small grant to conduct this study. Seven locations will be sampled for ozone pollution on a 2-week schedule for 18 weeks, ending September 14. The samplers are a low cost and accurate method of measuring average ozone concentration. Jim Renfro led the training on May 3 at the Blount County Health Department. All of the passive ozone sampling equipment was loaned to the Blount County study by the National Park Service. You can view results from a recent passive ozone study at the Park in 2000 on the following web sites.
http://www2.nature.nps.gov/air/studies/O3study.htm
http://www2.nature.nps.gov/air/studies/docs/GRSM_PS_study_poster.pdf

The data will be analyzed in the fall of 2004 and compared to the continuous measurements at Look Rock and Cades Cove and surrounding region for accuracy and precision and to determine spatial and temporal differences of ozone in Blount County at the seven locations. A story in the Maryville Times was published on April 30. http://www.thedailytimes.com/sited/story/html/162574

OZONE EFFECTS TO VEGETATION RESEARCH: Researchers from Auburn University, Appalachian State University, University of New Castle UK, DOE-Oak Ridge National Lab, University of Tennessee, EPA, NOAA, and USDA continued with their third year of NPS funding studying the effects of ground-level ozone pollution on native wildflowers and tree species in the park. The researchers are studying a number of things including visible foliar injury, growth, photosynthesis, genetics, drought interaction, ozone exposures, microclimate, and other factors in determining the sensitivity of a variety of species sensitive to ozone such as cut leaf coneflower, tall milkweed, crown-beard, black cherry, and yellow-poplar. Work on these "bio-indicator" species is focused at Look Rock, Twin Creeks, Clingmans Dome, and Purchase Knob areas of the park. A recent story in the Knoxville News-Sentinel summarizes some of this work:
http://www.knoxnews.com/kns/science/article/0,1406,KNS_9116_3163350,00.html

NEW JOURNAL PUBLICATION: A recent journal article reports the results of an EPA-funded ozone effects to vegetation research project at the park. Portable monitors were used to measure ozone concentrations above and within the canopy of ozone symptomatic and asymptomatic cut leaf coneflower stands at Purchase Knob (elevation 4,900 ft). Ozone exposure measurements showed concentrations decreased as one descended into the canopy from above. Concentrations near the ground were about half those measured one meter above the canopy. The measurements were used to test the accuracy of an ozone deposition model in predicting concentrations within the canopy. Determining ozone concentration as a function of height within the canopy will allow better correlation of ozone concentration with severity of foliar injury. The citation for the article is P.L. Finkelstein, A.W. Davison, H.S. Neufeld, T.P. Meyers and A.H. Chappelka. 2004. Sub-canopy deposition of ozone in a stand of cut leaf coneflower. *Environmental Pollution* 131:295-303.

CARBON 14 AEROSOL STUDY AT LOOK ROCK: A 6-month study was started at Look Rock on June 1 to collect weekly ambient carbon particulate matter samples for Carbon 14 analysis. Currently, the park has been monitoring organic carbon and elemental carbon since 1988. Carbon can make up 40 percent of the fine mass and contribute 20 percent of the haze at the park. As the park continues to work with states and the Environmental Protection Agency to achieve the Regional Haze Rule (and

the PM2.5 public health standard) of natural conditions by the year 2064, it will be important in understanding the chemical composition and sources of carbon. Determining the exact origin of all of the carbon is still an unanswered scientific question. A hi-volume particulate sampler was installed last month that will collect the carbon on a large filter for analysis at University of California – Davis. The purpose of the study is to separate and analyze two major carbon source categories (ancient/fossil & modern). The study is a two-stage project that will run during the summer three months (June-August) and winter three months (December-February). There are 5 other sites participating in this study that probably have different source impacts of the carbon including Bondville, Illinois; Proctor-Maple, Vermont; Puget Sound, Washington; Mount Rainier, Washington; and Washington, D.C. Some of the possible carbon sources include fresh mobile source urban emissions, aged urban carbon, secondary organics from trees, agriculture burning, and secondary organics from petrochemical.

AEROSOL ION STUDY AT LOOK ROCK: A special study was conducted at Look Rock during the summer of 2004 (July 20 – August 19) by the University of California, Davis, Colorado State University – Cooperative Institute for Research in the Atmosphere, and the National Park Service-Air Resources Division. The study was part of multi-year IMPROVE (Interagency Monitoring of Protected Visual Environments) Study. The focus of the study was on the characteristics of airborne particulate ions in the humid, acidic environment of the eastern U.S. Specific components of the study included 1) investigations of nylon filters to look at (a) ammonium loss and (b) water extraction efficiencies (vs. basic IC eluent extractions), 2) measurement of aerosol acidity, 3) measurement of ion size distributions, 4) time-resolved (15 minute) measurements of ion concentrations, and 5) assessment of sample modification due to exposure to ambient gaseous ammonia.

PM10 – PARTICULATE MATTER STUDY: The Interagency Monitoring of Protected Visual Environments (IMPROVE) Program funded and University of California-Davis and Park staff installed three PM-10 (particulate matter less than 10 microns in diameter) monitors at Look Rock in May, 2003. The study will last 2 years. The filter-based particulate samplers will be analyzed for mass and chemical composition. Historically, PM-10 filter samples have not been routinely speciated for chemical composition, only for mass. This will be an interesting study to learn what's in the course fraction of particulate matter and how that affects visibility. Results of this study will be presented at the Air & Waste Management Association Visibility Speciality Conference the week of October 25, 2004 in Asheville North Carolina. The link to the conference is at:
http://www.awma.org/events/confs/Haze%202004/haze%20default.asp
The IMPROVE web site can be accessed at: http://vista.cira.colostate.edu/improve/

REGIONAL HAZE "FOCUS MONITORING SITE": The Visibility Improvement State and Tribal Association of the Southeast (VISTAS) identified three locations in the southeastern U.S. to install enhanced particle monitoring "Focus Sites." Look Rock was one of the locations and in the spring of 2003, Roger Tanner (TVA) was awarded the contract to operate and maintain continuous (hourly) particle measurements of sulfate, nitrate, and carbon for 2003 and 2004. This data will assist in the VISTAS atmospheric model performance efforts and will be necessary to conduct a better analyses and modeling effort that is needed for the VISTAS states to comply with the requirements of the federal regional haze regulations. The two other "focus sites" include Cape Romain National Wildlife Refuge and Millbrook, North Carolina. The link to the VISTAS web site is: http://www.vistas-sesarm.org/

CLOUD MONITORING AT CLINGMANS DOME: The EPA contractor MACTEC Environmental and Consulting re-installed the cloud and dry deposition monitoring equipment at the Clingmans Dome air quality monitoring station on June 5-8. Don Ho, VIP for the park will be the sub-contractor responsible for operation of the site through October. This will be the 11th straight year of operation. The Smokies is only one of two sites in the eastern U.S. that has an automated cloud collector. The other site is on Whiteface Mountain, New York. Ozone, meteorology, and mercury deposition is also monitored at the site. Previous results indicate that cloud deposition at Clingmans Dome accounts for over half of the total acid deposition (wet, dry, cloud), averages 3.6 pH (1000 times more acidic than natural rainfall of 5.6 pH), and shows that the site is in clouds approximately 50 percent of the time. This work is important to show trends in deposition as reductions in sulfur dioxide and nitrogen dioxides are made

over the course of the next decade. This work is made possible by the co-funding of EPA Region IV, TVA, and NPS-Air Resources Division.

VISIBILITY ASSESSMENT – REGIONAL PLANNING ORGANIZATIONS – VISTAS (VISIBILITY IMPROVEMENT – STATE AND TRIBAL ASSOCIATION OF SOUTHEAST): Because the pollutants that lead to regional haze can originate from sources located across broad geographic areas, EPA has encouraged the States and Tribes across the U.S. to address visibility impairment from a regional perspective. Today, EPA provides funding to five regional planning organizations to address regional haze and related issues. These organizations will first evaluate technical information to better understand how their States and Tribes impact national park and wilderness areas (Class I areas) across the country, and they will then pursue the development of regional strategies to reduce emissions of particulate matter and other pollutants leading to regional haze.

In 1999, the U.S. Environmental Protection Agency announced a major effort to improve air quality in national parks and wilderness areas. The Regional Haze Rule calls for state and federal agencies to work together to improve visibility in 156 national parks and wilderness areas such as Great Smoky Mountains National Park. The rule requires the states, in coordination with the Environmental Protection Agency, the National Park Service, and other interested parties, to develop and implement air quality protection plans to reduce the pollution that causes visibility impairment. The first state plans for regional haze are due in the 2005-2008 timeframe. Five multi-state regional planning organizations are working together now to develop the technical basis for these plans.

The Visibility Improvement State and Tribal Association of the Southeast (VISTAS) is a collaborative effort of state governments, tribal governments, and various federal agencies, including the National Park Service and Great Smoky Mountains National Park, established to initiate and coordinate activities associated with the management of regional haze, visibility and other air quality issues in the Southeastern United States. Member States and Tribes include: the States of Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, and West Virginia and the Eastern Band of the Cherokee Indians. For more information on VISTAS, visit http://www.vistas-sesarm.org/

EPA'S CLEAN AIR INTERSTATE RULE (CAIR): The Bush administration released a supplement to its proposed Clean Air Interstate Rule on May 19, 2004, providing additional implementation details, including model cap-and-trade programs for power plants that states may adopt to achieve required emissions reductions. The Clean Air Interstate Rule would establish permanent caps significantly reducing emissions of nitrogen oxides (NOx) and sulfur dioxide (SO2) in the eastern United States. In 2015, NOx emissions from the electric power sector would be 65 percent below today's levels. SO2 emissions from that sector would be 50 percent below current levels by 2015 and about 70 percent below when fully implemented.

The proposed supplement provides for the use of a cap and trade program, like the Clean Air Act's Acid Rain program, to ensure complete accountability and transparency as this rule is implemented. Each of the 29 eastern U.S. states affected and the District of Columbia must submit a plan to EPA that demonstrates how it will meet its assigned statewide SO2 and NOx emissions budget.

The Clean Air Interstate Rule (proposed in January 2004, formerly the Interstate Air Quality Rule to Reduce Interstate Transport of Fine Particulate Matter and Ozone) is tool that will help communities achieve clean air and meet the health-based fine particle and 8-hour ozone standards. When combined with the recently completed Clean Air Non-road Diesel Rule and other national control programs, the reductions required by the Clean Air Interstate Rule will achieve significant regional improvements in air quality and reduce the need for additional local controls.

EPA will take public comments on the supplemental proposal for 45 days after publication in the Federal Register. EPA held a public hearing on June 3 in the Washington, D.C. area to solicit comments. For more information on the supplemental proposal, the public comment and hearing processes, and the January 2004 proposed Clean Air Interstate Rule, visit: http://www.epa.gov/interstateairquality .

EPA'S CLEAN NON-ROAD DIESEL RULE: The Bush Administration's Clean Air Non-road Diesel Rule, signed on May 11, 2004, will cut emission levels from construction, agricultural and industrial diesel-powered equipment by more than 90 percent. The new rule will also remove 99 percent of the sulfur in diesel fuel by 2010, resulting in dramatic reductions in soot (or particulate matter) from all diesel engines.

The Clean Air Non-road Diesel Rule is one of the latest rounds in EPA's decade-long effort to make diesel engines and fuels cleaner. This new rule complements the Clean Diesel Truck and Bus Rule (announced December 21, 2000), which will put the cleanest running heavy-duty trucks and buses in history on America's roads, building a fleet that will be 95 percent cleaner than today's trucks and buses. On-highway compliance requirements take effect with the 2007 model year. For more information on the Clean Non-road Diesel Rule, visit http://www.epa.gov/cleandiesel/#cleanairrule .

EPA BEST AVAILABLE RETROFIT TECHNOLOGY (BART) REQUIREMENTS: The EPA, on May 5, proposed to amend its regional haze rule to provide guidelines for state and tribal air quality agencies to use in determining how to set air pollution limits for a number of older, large utilities and other industrial plants, to address visibility impairment in scenic areas, like Great Smoky Mountains National Park. In May 2002, the D.C. Circuit Court vacated certain provisions of the regional haze rule related to best available retrofit technology (BART). Because of this remand, EPA needed to re-propose guidelines intended to add further clarification to the BART requirements in the regional haze rule. The purpose of this rulemaking is to provide the appropriate changes to the BART requirements and guidelines.

The BART requirements of the regional haze rule apply to facilities built between 1962 and 1977 that have the potential to emit more than 250 tons a year of visibility-impairing pollution. Those facilities fall into 26 categories, including utility and industrial boilers, and large industrial plants such as pulp mills, refineries and smelters. Many of these facilities previously have not been subject to federal pollution control requirements for these pollutants.

The BART requirement directs state air quality agencies to identify whether emissions from sources subject to BART are well controlled, or whether retrofit measures are available to reduce the emissions below current levels. For some of the source categories, existing technology often can reduce emissions by up to 90 to 95 percent. Implementation of this proposal would result in reductions of 2.2 million tons of sulfur dioxide and 1.2 million tons of nitrogen oxides from the power sector by 2015.http://www.epa.gov/air/visibility/actions.html

CULTURAL RESOURCES – David Chapman, (865-436-1249)

ADDITION TO STAFF: This year, the cultural resources staff was pleased to welcome the addition of four summer Student Conservation interns and one volunteer. They helped to provide much needed support for the Cultural Resources program during the heaviest workload season. Most of the work done by the Cultural Resources branch focused on compliance and planning. Additionally, Cultural Resources staff was deeply involved in the assessment of effects for eight major planning projects for Cades Cove, Elkmont, Greenbrier, Newfound Gap Road, Roaring Fork/Cherokee Motor Nature Trail, the North Shore Road, Ravensford, and Twin Creeks.

COMPLIANCE AND PLANNING: This fiscal year twenty-six Requests for Environmental Compliance were received and processed. Nine small projects required test excavations in reaction to the Park's compliance needs. One project was proactively undertaken that identified a Late Archaic site along the Appalachian Trail. One hundred and five shovel tests were excavated. In preparation for connecting power lines to the electronic sign at the Oconaluftee Visitor Center Variable Messaging Sign eleven backhoe trench excavations were excavated and recorded. In addition, one project required a linear surface pedestrian survey along six miles of trail. Two surface pedestrian surveys were completed in preparation for prescribed fires; one survey included limited shovel testing.

In addition to completing work on the Great Smoky Mountains National Park, Erik Kreusch, the Park Archaeologist has assisted the Blue Ridge Parkway in meeting their compliance needs. Through a cooperative agreement with the parkway, the staff is continuing archaeological work on the proposed Mountain to Sea Trail. To date, fifty seven shovel tests have been excavated.

CADES COVE TRANSPORTATION PLANNING AND DEVELOPMENTAL CONCEPT PLANS: John Milner Associates, Inc., the subcontractor for the Cultural Landscape Report (CLR) for the Cades Cove Historic District, has completed the CLR. The CLR is the primary guide to the treatment and use of a cultural landscape. It analyzes and documents the landscape's development and evolution. It will also make treatment recommendations consistent with the landscape's significance, condition and planned use. If funding is available, the CLR will be printed during 2005. Efforts to identify other cultural resources, such as archaeological and ethnographic, will be undertaken or are currently underway. Because of the large geographic area, the identification of all the archaeological resources within Cades Cove would be impractical and imprudent. Therefore, the park has undertaken an approach for the identification of archaeological resources that will examine where intact archaeological resources are most likely to be present by examining where preservation of these resources is most likely. A common way of achieving this goal is by examining topographic settings and erosional/depositional processes. Therefore, the park will be conducting geologic investigations that will define broad physiographic areas within Cades Cove that are conducive to the preservation of prehistoric archeological resources. Future archaeological work will then focus on testing these identified areas.

ELKMONT HISTORIC DISTRICT: The contractor for the Environmental Impact Statement (EIS) has completed the impact analysis of the proposed alternatives and has submitted a draft Environmental Impact Statement (DEIS) for park review. Initial archaeological surveys have been completed for the Elkmont Historic District and have identified eight broad and artificially created site "areas." These areas are delineated by topographic features, such as waterways and steep slopes, and by modern landscape features, such as roads and trails. Therefore, these site boundaries do not represent individual sites but include a multitude of different time specific artifacts and activities in the same artificially defined site "area." Materials recovered are extensive and are associated with prehistoric and historic use of the area. Evidence of Middle Archaic to Woodland period occupations were identified, as well as, historic components associated with both the resort-era occupation and two earlier home sites. Additional archaeological work will be required prior to any ground disturbing activities and will attempt to more clearly define time specific activity areas.

GREENBRIER ROAD WIDENING: To date, archaeological studies undertaken for the proposed road widening at Greenbrier have been completed. Excavation of large excavation units has uncovered evidence of a continuum of human occupation dating back to 10,000 years ago. Archaeological evidence also identified the remains of an early 19th historic structure, believed to be that of Sam Profitt. Currently, the park in coordination with the Federal Highway Administration (FHWA) is developing alternatives that will address any environmental concerns as well as consider road safety. Once these alternatives are developed, a comprehensive plan for the treatment of archaeological resources directly impacted by any proposed construction will be developed.

TWIN CREEKS SCIENCE CENTER: At Twin Creeks, four larger excavation units were employed at two different sites to assess National Register eligibility. Additional archaeological testing was completed east of the proposed footprint of the Twin Creeks Science Center and in an area proposed for a parking lot extension. The goals of the archaeological work were to determine the extent of the cultural materials present, the types of activities and timing of events that took place on the site, and to determine the integrity and significance of archaeological materials. The archaeological survey east of the proposed Twin Creeks Science Center footprint recovered both historic Euro-American materials and prehistoric Middle Woodland (700 BC -200 AD) period artifacts. Historically, the site was utilized as a homestead as evidenced by a chimney fall and household goods recovered from excavations. Prehistorically, the site served a similar purpose, although no evidence of structures was identified in the limited excavations that were employed. The occurrence of prehistoric pottery, projectile points, nut processing tools, and a possible pit feature were identified and suggest some

semi-permanence on the site. The site is considered eligible to the National Register of Historic Places (NRHP). The area proposed for a parking lot at Twin Creeks identified human occupation during the Middle to Late Archaic (6000 B.C.- 1000 B.C.). Archaeological evidence, such as the recovery of burned clay daub and a charcoal rich pit feature, suggest the area was utilized semi-permanently and future work could identify the remains of a prehistoric household. The charcoal rich pit feature identified in shovel test pit excavations, was excavated in a large block. Material was collected from the feature that will be analyzed for plant and animal remains. The charcoal recovered from the feature will provide a radiocarbon date. The site is considered eligible to the NRHP and plans for the construction of the parking lot extension will be modified to preserve the archaeological deposits.

ROARING FORK/CHEROKEE ORCHARD ROAD: The park has initiated a planning process and Environmental Assessment (EA) for the rehabilitation of the Roaring Fork/Cherokee Orchard Motor Nature Trail. Currently, the park is developing alternatives for the project. Once these have been finalized they will be evaluated for potential impacts to natural and cultural resources. As part of process, a Cultural Landscape Report (CLR) has been started for the Roaring Fork and Cherokee Orchard Historic Districts. The CLR is the primary guide to the treatment and use of a cultural landscape. It analyzes and documents the landscape's development and evolution. It will also make treatment recommendations consistent with the landscape's significance, condition and planned use. The contractor will also conduct limited archaeological investigations along segments of the route as part of the compliance process.

NEWFOUND GAP ROAD: The Great Smoky Mountains National Park, in coordination with the FHWA, is working on the completion of an Environmental Assessment (EA) for the rehabilitation of Newfound Gap Road in North Carolina. Archaeological studies have been and are currently underway at four intersections proposed for improvement, including the intersections at Collins Creek Picnic Area, Tow String Road, Smokemont Campground Road, and the Big Cove Connector Road.

NORTH SHORE ROAD: The Great Smoky Mountains National Park (GRSM) in cooperation with the Federal Highways Administration (FHWA) has been engaged in the preparation of an Environmental Impact Statement (EIS) to analyze alternatives for resolving issues related to the North Shore Road in North Carolina. In 2004, the completion of an existing conditions report was completed. This document serves as background research from documentary and archival sources on the history of the North Shore area. From this initial research, the park has begun undertaking some limited archaeological investigations within the first five miles of the proposed road corridor. This five mile section, beginning at the existing tunnel, was chosen for archaeological scrutiny because it is the common corridor proposed in the build alternatives. A model was developed to sample areas within this corridor. Slope was a variable utilized in the model. Therefore, areas were selected for archaeological testing according to slope percentage. Analysis of the findings is forthcoming. This data will be used to predict archaeological site locations in areas outside of the present survey and will be used in the refinement of build corridor alternatives.

PUBLIC HISTORY AND ARCHEOLOGY: The staff continued its outreach by providing interpretative talks and field experience in archaeology at several venues. These included an Archaeological Practicum for the Smoky Mountain Field School through the University of Tennessee's Continuing Education Department and a field Practicum at Twin Creeks for Experience Your Smokies. The design and initiation of the Great Smoky Mountains Archaeological Field School through the University of Tennessee's Archaeological Research Laboratory began its inaugural season. This month-long field school had UT students learning archaeological technique by excavating both inside and outside of the park. This program to train students in archaeological work will continue and expand in the coming years.

APPLIED ETHNOGRAPHY: In continuing the National Park Service's commitment, Great Smoky Mountains National Park has initiated several ethnographic studies as a part of larger planning processes to consider the perspectives of historically-connected communities and the activities in which they take part. It is from fully characterizing a group's way of life that ethnographers help determine the significance of park resources, outline special relationships between groups and parks,

provide management with information used in decision making, and in other ways help mediate and reconcile traditional uses and values with the Park Service mission. Ethnographic studies are underway as part of the North Shore Road and Cades Cove Opportunities Plan processes and will be incorporated into the decision-making process. In addition, an ethnographic study is underway in the Cosby area of the park that is attempting to gain historical insight into the life ways, perceptions, and meanings of this unique area to present and former residents.

MUSEUM ACTIVITIES: A total of 18,371 artifacts were cataloged this year. The number includes approximately 13,500 archival pieces, which include correspondence, reports, photographs, and maps. The summer SCA's and other archaeological staff cataloged a total of 4,871 archaeological artifacts including projectile points and many, many flakes. To their credit, most of this work was done in a 3 month time period over the summer averaging almost 1,000 objects per person. The move of the cultural collection to a temporary storage facility in the Office of Scientific and Technical Information in Oak Ridge, Tennessee, was completed and 90 percent of the collection is now unpacked, about 65 percent is inventoried. Inventory will be ongoing throughout 2005. Even with the disarray, museum technician Maryann Neubert managed to conduct 7 tours to interested visitors and other museum professionals. In late August, the collection also hosted textile conservator Deborah Bede who surveyed the entire textile collection for future conservation needs. The most notable new discoveries in the collection are ones we've had for about 30 years—the Walker Sisters Collection. After many years of being boxed in crates the entire collection was opened by archaeological technician Ann Chancey and throughout the next year, if not several, all the objects will be inventoried completely and vague catalog records will be updated with more information painting a complete picture of this fascinating collection.

LIBRARY ACTIVITIES: In FY 2004, the Library had 125 appointments (by park visitors) for assistance in using the research area. Additionally, the Library responded to 191 email requests for information, and 31 requests to have photos made. (The park's historic photos are sought for use in books, restaurants and inns, technical reports, family collections, oral presentations, museums, CDs, and Web sites.) The Library also added 79 new titles (books) to the collection (about 20 by purchase, 40 by donation from the GSMA, and 19 by gift). And, at the close of the year, a project of digitizing the Oral History Collections of the Library & Archives was begun.

FIRE MANAGEMENT – Leon Konz, Branch Chief (865-436-1247)

WILDLAND FIRES (HUMAN AND LIGHTNING-CAUSED): The park had three human-caused fires (all arson) and all were in the western portion of the park in Tennessee. A total of 191 acres burned. While the number of ignitions and total acreage is not very high, the number of structures threatened was above average. One fire set near the Look Rock Ranger Station threatened it. One fire set near the mouth of Abrams Creek threatened private structures; the landowner used his dozer to put in a fire line to protect his buildings. In addition, the park employees assisted Blount County on at least two other occasions in the protection of structures.

The park had one lightning-caused fire that was managed for resource benefits. This was the Shot Beech fire which started June 13 and burned for 35 days during which time it survived several inches of rain. Interestingly, the fire consisted of a single 35-foot hemlock snag that burned down to 12-feet before going out. Only a few square feet of vegetation burned on the ground.

FUELS TREATMENTS/PRESCRIBED FIRES: The park completed five prescribed fires during the year for a total of 448.5 acres. Four of them involved burning hand-made piles at Ace Gap, Highlands and the Bypass project sites. Noteworthy among the pile burning is when the Fire Use Module burned approximately 600 piles in three days at Ace Gap. The fourth was the Wash Ridge prescribed fire. The park Fire Ecologist wrote "In qualitative terms, the Wash Ridge burn was an outstanding first-entry of fire back into a fire adapted landscape. Weather conditions on days one and three of the burn were very near the optimal prescription conditions; in particular, the relative humidity on those days was at the "warm" end of the prescription."

In addition, at least four major prescribed fire challenges were highlighted during the year. First, the Fire Ecologist worked closely with the U.S. Fish and Wildlife Service and the Park Wildlife Biologists to develop the guidelines on prescribed fire in respect to the federally endangered Indiana Bat. When burns can occur and when preparation work can be done is limited. Secondly, the need to satisfy the requirements of pre-burn cultural resource surveys while at the same time trying to accomplish landscape-sized fires to accomplish the park's mission of perpetuating existing biotic diversity. Thirdly, the park must pay closer attention to ozone emission levels since the park was designated a Non-attainment Area by the EPA. Fourthly, it has become increasingly clear that the park needs to define the desired future conditions of the park's vegetation types given that landscaped-sized fires are now taking place.

PLANNING/PREPAREDNESS ACTIVITIES: There were several significant planning related activities completed this year. One of the most important occurred on September 15 when Superintendent Dale Ditmanson approved the second version of the Park's Fire Management Plan. The revision was the result of work over two years by a contractor, a Park Task Force, Regional Fire Staff and various individuals from the park. Another significant accomplishment was the initiation of the Fire Program Analysis (FPA). This new interagency budgeting and staffing system will be used to allocate resources jointly between the Park, Cherokee National Forest, and Eastern Band of the Cherokee Indians and other nearby park units. In order to help implement the system, the Park hosted a team of FPA experts to help prepare for the implementation. The team worked on fuel modeling, fire history, fire occurrence, inspecting weather records and developing program specific fire management units. A side benefit to this project is that the park will receive a GIS data layer with all of its known fires. This produce will be a very power tool for many disciplines to use in the future.

The Preparedness Staff updated the Park's Preparedness Plan; they started from scratch and developed a very good product. In addition, they developed Park-specific Readiness Review checklists for the Fire Office, Engines, Fire Caches, and individual fire fighters. This will certainly help in being prepared for fire responses. Training is always an important function and the staff taught four, eight-hour Annual Fire Fighter Refresher classes, two in North Carolina and two in Tennessee. In addition, they taught the basic fire course twice; once for the interagency cooperators and once for three volunteer fire departments. The Pack Test was given numerous times to qualify fire fighters for fire line duty. Lastly, they responded to four wildland fires and assisted with four prescribed fires.

RURAL FIRE ASSISTANCE (RFA) PROGRAM: This is the park's fourth year working with the RFA program. As in the past, it worked with ten fire departments and dispersed $64,630. In the preceding three years of this program, funds were allocated for equipment, supplies, personal protective equipment, and training materials. For the first time, the park accomplished the goal of teaching the basic fire courses to some Departments. Three Departments had this training opportunity. Next year we are planning to offer the same opportunity to three different departments.

FIRE ECOLOGY/EFFECTS: The Great Smoky Mountains fire effects crew supported fire programs in ten National Park Service units during FY 2004, including monitoring, prescribed fire operations, and planning. This included seven parks throughout the Southeast Region as well three parks in the Pacific West and Intermountain Regions. In all, more than 35 vegetation/fuels plots were monitored, including program start-ups at Big South Fork NRRA and Cumberland Gap NHP. Virginia McDaniel presented some exciting results from our Great Smoky Mountains data at the International Fire Ecology Conference as well as this year's Ecological Society of America annual meeting. The analyses that were presented at these meetings will serve as a springboard for future investigations into our fire ecology. Finally, the fire ecology program worked on testing the first versions of a new National Park Service fire effects database that will help to modernize our program and make future data sharing and analysis much more streamlined than in the past. The final transition to the new database should be complete by next spring.

FIRE USE MODULE (FUM): The Module was fortunate to have a veteran crew back for the year. As a result, there were many accomplishments. It was able to accomplish most of the prescribed fire projects that the Southeast Region was tasked with in FY 2004. Prescribed fire projects were

completed at Great Smoky Mountains, Mammoth Cave, Kings Mountain, Congaree Swamp, and Cowpens. In addition, it participated in a historic 11,000-acre unit on the Buffalo National River. The FUM worked on two Wildland Fire Use fires; one at the Smokies and one at the Grand Canyon. Between the two fires, significant fire monitoring experience was obtained by four individuals.

Training and development of employees was impressive. Task Books completed were for Fire Effects Monitor, Faller Class B, Engine Boss, Incident Commander Type IV, and Helicopter Crewmember. Employees participated in the following courses: Sand Table Exercises, Fire Business Management, Wildland Fire in the Urban Interface, Pumps and Saws, Ignition Techniques and Helicopter crewmember. Three crewmembers had prolonged details with the Great Northern Crew in Missoula, Montana, the Mesa Verde Helitack crew at Mesa Verde NP and the Craig BLM District in Colorado. The experience gained by crewmembers in these diverse assignments is one of the key reasons why the Module has such a wide range of knowledge, skills, and abilities.

KNOXVILLE TANKER BASE (KTB): The national air tanker program was rocked by the cancellation of all "heavy" air tanker contracts on May 10, 2004 due to airworthiness concerns. May 10 was the day after Tanker 68 completed its spring contract at KTB. Fire danger was low in the Southern Appalachians during the spring season, so Tanker 68 spent most of it detailed to the Lake City, Florida base for response to wildland fires.

Contrary to what one would guess with the contract cancellation, the KTB Staff had a busy year. Base Manager Doug Ivey completed five Western wildland fire assignments during the year serving as Base Manager of a portable base in Payson, Arizona. He also assisted with managing aircraft assigned to the Florida hurricane incidents. Lastly, he assisted with the national tanker program by collecting data on tankers in California as part of the Aircraft Health Monitoring Systems study.

Other accomplishments included working with interagency partners to write position descriptions and a Transition Plan for the new Chattanooga Tanker Base (CTB). Ground preparations for the construction of the new base have been completed; however, it is unknown when the building and mixing plant will be constructed. The retardant mixing plant was repainted and, as usual, the KTB Staff maintained the park's remote weather stations used in the calculation of fire danger. The Superintendent hosted a visit by the USFS Regional Fire Management Officer and the Cherokee NF Fire Staff Officer. They requested the visit to inform the Superintendent that they hoped that he would be willing to have the park manage the new CTB, should that opportunity ever present itself.

EMERGENCY STABILIZATION AND REHABILITATION: For the third and last year, the park received $24,000 of Emergency Stabilization and Rehabilitation funding to monitor the invasive nonnative plants on the Sharp and Green Mountain fires. The Supervisory Forester hired two furloughed fire staff members to accomplish the field work, which consisted of inspecting sites and treating the nonnative plants.

DISPATCHING – ROSS: Generally speaking, few employees were dispatched out of the park this year. The primary reason being was that the National Preparedness Level did not exceed level thee all year. Very significantly though, this was the implementation year for the nation-wide Resource Ordering and Status System (ROSS). This system links the park to state and Regional Coordination Centers as well as the incident itself, regardless of its location. This system is very labor intensive and has created significant new workload that requires additional FTE to implement. Also implemented this year was a new qualification system called Incident Qualification Certification System (IQCS). IQCS is designed to interface with ROSS to ensure qualified individuals are assigned to incidents. This new program, too, is very labor intensive.

RESEARCH: The park continues to work with several universities and agencies to accomplish a wide range of fire research. Noteworthy last year was a project by the Aldo Leopold Wilderness Research Institute of the Rocky Mountain Research Station. A study entitled "Can Wildland Fire Use (WFU) Restore Historical Fire Regimes in Wilderness and Other Unroaded Lands? This study showed that lightning-caused fires in the park cannot perpetuate the park's biodiversity. This point highlights the need for landscape-sized fires to accomplish agency and park goals.

FISHERIES MANAGEMENT – Steve Moore (865-436-1250)

BROOK TROUT RESTORATION MONITORING AND REINTRODUCTION: The 3.2 miles of Bear Creek treated with Antimycin in 2003 was surveyed to determine if all rainbow trout had been removed from the stream. One rainbow trout was collected and immediately removed from the stream. One month later with assistance from North Carolina Wildlife Resources Commission personnel, 200 brook trout from the headwaters of Forney Creek, Steeltrap Creek and Huggins Creek were collected and released into Bear Creek. Sams Creek was also surveyed to evaluate the success of brook trout reintroductions in 2002 and to evaluate the downstream movement of brook trout from headwater refuge areas. The survey revealed limited downstream movement of brook trout from the headwater refuges and that a flood in May 2003 had hampered the survival and reproductive success of brook trout reintroduced in 2002. Based on this information, 50 brook trout were collected from the refuge areas and transported downstream and released. Additionally, 155 brook trout were collected from Cosby Creek and Little Greenbrier Creek and released in the first mile of Sams Creek upstream of the barrier.

EXPERIMENTAL BROOK TROUT FISHERY: The park's brook trout fishery was closed to fishing for 27 years because of concern that the park harbored a southern Appalachian endemic that was being impacted by a number of factors, including fishing pressure. However, comparisons of population data from streams open to fishing and those closed to fishing revealed no differences in population parameters. Population monitoring and creel data from the eight streams open to fishing and the eight control streams indicate that angling has had no impact on the populations. In fact, in most of the streams open to fishing, the numbers of brook trout greater than seven inches actually increased after the streams were opened to fishing. Creel survey data indicate most anglers are not keeping brook trout, they simply want the opportunity to fish for this native fish and that they believe acid deposition is the greatest threat to their continued survival.

WATER QUALITY MONITORING: In conjunction with the University of Tennessee and Trout Unlimited volunteers, park-wide water quality samples were collected bi-monthly from 46 sites. Water samples are collected from 34 sites by Trout Unlimited volunteers. These samples are analyzed by the University and become part of the park's long-term water quality database as part of its long-term monitoring program. Data from the first 10 years of the program were analyzed for redundancy, frequency, whether geographic gaps in data collection are apparent, and the need to collect storm event samples. The results allowed the park to decrease the number of samples collected from 86 to 46 and to increase sampling frequency.

TECHNICAL ASSISTANCE: Steve Moore and Matt Kulp assisted Great Sand Dunes National Park with the planning of a Rio Grande Cutthroat trout restoration project. If implemented, the project will restore three alpine lake and 15 miles of stream for this native trout. The fisheries crew also assisted biologist from the Sumter National Forest and South Carolina Department of Natural Resources with the planning of a brook trout restoration project for King Creek. The implementation of this project was delayed until August 2005 because of NEPA compliance issues.

PROGRAMS and PRESENTATIONS: Steve Moore served as Symposium Chairman for the international Wild Trout Conference in Yellowstone National Park. The symposium was attended by over 200 people from across the U.S. and Canada. One biologist from England and one from Australia also attended. Kulp and Moore summarized 60 years of fishing regulation history for the park and submitted this article for publication in the N. A. Journal of Fisheries Management. The article has been accepted for publication and will be printed in early 2005. The fisheries staff gave 10 presentations related to fisheries activities to Trout Unlimited Chapters in four states. Additionally, they gave five presentations to university classes, Leadership groups from Sevier and Blount Counties and local schools related to fisheries monitoring and management activities.

PARK PLANNING PROJECTS PUBLIC PARTICIPATION:

CADES COVE OPPORTUNITIES PLAN: http://www.cadescoveopp.com. A consultant has been selected for the next phase of Cades Cove Opportunities Plan work. Once begun, this phase is anticipated to last 18 months and will include refinement of alternatives, a capacity study, public involvement, and affected environment and environmental consequences reports. This is the basic information needed to develop a draft Environmental Impact Statement. More review and public comment will follow.

ELKMONT HISTORIC DISTRICT PLANNING: http://www.elkmont-gmpa-ea.com
Public meetings held in March presented detailed project alternatives and their Areas of Potential Effect (APE) that will be discussed and analyzed in the Draft EIS (DEIS). A summary of those public meetings is available at http://www.elkmont-gmpa-ea.com/Mar04PubMeet.PDF. The analysis of project alternatives and associated impacts related to each alternative is concluding and the DEIS is currently being compiled for release this fall, 2004. If you would like to provide input on the management of the Elkmont Historic District, or receive e-mail updates, contact us at:

Superintendent
Great Smoky Mountains National Park
107 Park Headquarters Road
Gatlinburg, TN 37738
E-mail ElkmontComments@tnainc.com

PROPOSED NORTH SHORE ROAD: http://www.northshoreroad.info
Project personnel are currently conducting in-depth fieldwork, interviews, and research in and surrounding the North Shore Road project area involving natural resources, community and visual resources, historic resources, and social customs. The information collected will be provided to the project study team to evaluate the potential impacts of the final study alternatives to the human and natural environments within GSMNP. No upcoming public meetings have been scheduled at this time. For more information or to provide comments on the project please contact us at:

North Shore Road Project
Great Smoky Mountains National Park
P.O. Box 30185, Raleigh, NC 27622

UPCOMING MEETINGS:

November 7, 2004, **Fall Volunteer Potluck Picnic**, Noon-6:00 p.m., Great Smoky Mountains Institute at Tremont. Discover Life in America volunteers, scientists, and Park staff and partners gather for a fine fall afternoon to enjoy good food and fellowship. Stay later and sit around a campfire! DLIA will provide hot dogs, burgers (including veggie), and drinks. RSVP to Anne Ramsden, (865) 430-4756 or anne@dlia.org. Bring a covered dish or dessert to share.

November 16-18, 2004, **SAMAB'S 15th Annual Conference-Quality of Life in the Southern Appalachians: Sustainability Through Stewardship and Cooperation,** Holiday Inn SunSpree, Gatlinburg, Tennessee. Join your colleagues and neighbors, stewards of the southern Appalachians, in exploring community and agency activities that preserve the quality of life in southern Appalachia. Keynote addresses by Dale Ditmanson (Superintendent, Great Smoky Mountains), Bill Baxter (Director, TVA), Jimmy Palmer (Regional Administrator, EPA), and Betsy Child (Commissioner, TDEC) will address air quality improvements made in the last 30 years and steps necessary to meet ozone, particulate, and visibility standards out to 2065.

December 7-10, 2004, **ATBI/DLIA Annual Conference,** Glenstone Lodge, Gatlinburg, Tennessee. Keynote speaker is renowned oceanographer and National Geographic Society Explorer in

Residence, Dr. Sylvia Earle, http://www.literati.net/Earle/index.htm. She will be speaking Friday, December 10. General sessions will be December 8-9. There will be a Pre-Conference workshop on data base and GIS on Tuesday, December 7. The DLIA Board meeting will be Saturday, December 11 at the Great Smoky Mountains National Park Sugarlands Training Room. There will also be a silent auction, socials and pre-conference workshop on a topic of interest. Check the website for more details and to register: www.dlia.org.

March 14-18, 2005, **People, Places, and Parks: Preservation for Future Generations**, Philadelphia, Pennsylvania. The 2005 George Wright Society Biennial Conference on Parks, Protected Areas, and Cultural Sites will be held in Philadelphia, Pennsylvania.

October 17-19, 2005, **Tall Timbers 23rd Fire Ecology Conference**, Bartlesville Community Center, Bartlesville, Oklahoma. Features of the Scientific Program will include The Seventh E. V. Komarek Memorial Fire Ecology Lecture and Special Sessions on Fire/Grazing Interaction in Grasslands (wild and domestic animals), Fire in Shrublands, Fire and Invasive Plants in Prairies, and Fire Management in Grassland/Woodland Complexes. They are seeking papers on all subjects above as well as related topics. Authors of all contributed papers, both oral and poster, will have the opportunity to publish them in the peer-reviewed Proceedings of the 23rd Tall Timbers Fire Ecology Conference.
To submit a paper, send a 1-page abstract, with author(s), affiliation(s), title and body of abstract to: Ronald E. Masters, Tall Timbers Research Station, 13093 Henry Beadel Drive, Tallahassee, Florida 32312 by June 1, 2005. For more information about the conference, visit the web site: www.talltimbers.org.

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BY THE AMERICAN PEOPLE SO THAT ALL MAY EXPERIENCE OUR HERITAGE.

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